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REVISED.

REPORT

ON THE

PREPARATION OF RINDERPEST PROTECTIVE SERUM

WITH FIFTY TABULAR STATEMENTS.

BY

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REVISED.

REPORT

ON THE

PREPARATION OF RINDERPEST PROTECTIVE SERUM.

Section I.—INTRODUCTION.

IT was in January 1900 that the necessity for certain researches was recognized, of which the results of the present report are the outcome. At that time we had neither means of ascertaining what was the best method of preparing anti-rinderpest serum, nor which breed of animals, plains or hills, bovines or buffaloes, were likely to produce a serum of the highest protective value. Further, it was a *sine qua non* that the serum produced should, if possible, be capable of protecting bovines and buffaloes alike, without causing serious results to the health of the injected animal, and from an economic point of view that the mode of preparation selected should be the least costly. It was fully recognized from the time of their initiation that such researches would, if they were to be of practical value, so as to include the several breeds of bovines and buffaloes in this country, take a considerable time to carry out, but the importance of the results to be obtained might be of such value, where large amounts of serum had, in the future, to be prepared, that it was felt that no obstacle, however great, should be allowed to stand in the way of the proposed experiments. Any one looking over the report and not being particularly interested in the results arrived at, might consider that a period of over four years was rather a long one, and perhaps unnecessarily so for producing results such as are now indicated. But when it is recognized that the two small figures 30 c.c. indicating protective value per 600 lbs. body weight of any serum for hill animals may have taken a period of 3 to 6 months to work out utilizing several or many susceptible animals in the process, when no indications were forthcoming by which a clue to the true dose necessary in each case respectively could be obtained, the time is certainly not a long one. Even now the *absolute* dose has seldom been specified in the case of hill animals, the actual amount being 2 or 3 c.c. either way, for in every animal experimented with, the susceptibility varied somewhat and it would be a difficult matter to find any two possessing identical susceptibility.

Further, many accidental circumstances militated against the progress of the experiments, putting a stop to them entirely during prolonged periods of 2 to 3 months, of which one only need be mentioned, *viz.*, on several occasions foot and mouth disease has been introduced by Bhotia animals coming in contact with the Laboratory ones either on their way to the Muktesar Laboratory or after their arrival there.

This report is submitted in its present form with a view to put on record the various results arrived at up to the present. It is my desire to follow up the conclusions now arrived at and add to the report from time to time the results of further investigations. Such a report, for the purposes of reference in a laboratory where serum is prepared, is almost indispensable, otherwise those in charge would have to work out all the details for their own use.

During the period that this research has been in progress, the undermentioned officers held the post of Assistant Bacteriologist, and for varying periods took part in the various injections, bleedings and testing experiments :—

Lieutenant G. K. Walker (now Captain), Civil Veterinary Department, up to September 1902.

Lieutenant J. D. E. Holmes (now Captain), Civil Veterinary Department, up to the present.

Various methods of protecting cattle against rinderpest.

(*i*) *Bile methods.*

Immunity from rinderpest is conferred upon certain breeds of cattle after the subcutaneous injection of 10 c.c. of bile taken from the gall bladder of an animal which has succumbed to a virulent attack of rinderpest (Koch's).

Rinderpest bile in 10 c.c. doses utilized before the 5th or 6th day of the disease does not confer immunity. The immunizing effect of the bile injection begins on the 5th day and is not complete until the 10th day.

Immunity against the disease by the use of rinderpest bile can be conferred upon plains bovines and plains and hill buffaloes, but not on hill breeds of cattle.

Rinderpest bile even in large doses (180 c.c.) does not confer immunity upon hill cattle. When larger doses than 180 c.c. are injected subcutaneously, death occurs within a few days, preceded by symptoms of poisoning, the most marked being tetanic movements of the limbs.

Fresh rinderpest bile confers an active immunity on the injected animal because the "contagium" of rinderpest is contained in a virulent form in the majority of fresh and powerful 6th day biles (Kolle). Its action is not curative. It requires 10 days before it imparts protection. Immunity lasts for from 2 to 5 months. The bile of from 3 to 7 animals required to protect each 100 animals operated upon.

Edington's glycerinated bile method.—This, in contradistinction to Koch's fresh bile method, can only in equivalent doses give a passive protection for a limited period, as glycerine destroys the "contagium" of rinderpest.

Injection of virulent blood after injection of bile.—10 c.c. of bile gives an active protection for 2 to 5 months, and the inoculation of virulent blood after ten days have elapsed, fails to prolong the period of protection already afforded.

Supposing that an animal received an active protection during 2 to 5, mean 3½ months, and if after the termination of ⅔ of the period or when the protective influence was passing off, a sufficient dose of virulent blood were inoculated subcutaneously, it should produce a reaction and a further term of active immunity.

(ii) *Serum simultaneous method.*

This method consists of the introduction of a certain quantity of fortified serum on one side of the animal's body and a small quantity of virulent rinderpest blood upon the opposite side. So long as the blood and serum are not placed sufficiently close to come into immediate contact, the fluids can be introduced on the same side of the animal's body. The immunity conferred on an animal after passing through this process is of an active character and varies in duration according to the severity of the attack. If little or no reaction is noticeable, nevertheless the animal receives a temporary protection. The advantages claimed for the serum by Kolle and Turner are:—

(*a*) "It can be prepared in large quantities."

(*b*) "It can be kept, and its strength ascertained before use."

(*c*) "It will not communicate any other disease."

(*d*) "As compared with defibrinated blood, it is much stronger. Thus one highly immunized animal at one bleeding can furnish enough material to immunize four or five times as many cattle as could be treated by one bleeding from an ox fortified by the older method."

(*e*) "It is consequently much cheaper, because fewer animals must be sacrificed to manufacture it, for between 3 to 7 per cent. of cattle must be killed to immunize 100 head with gall."

(iii) *Serum alone method.*

This method requires no explanation. According to the quantity of anti-rinderpest serum injected subcutaneously, a passive immunity against the disease is conferred for a longer or shorter period.

By driving cattle which have received the required dose of serum according to their individual susceptibility, amongst the number of an infected herd, a percentage of the exposed cattle may contract the disease and have an active protection conferred, which will last according to the severity of the attack each animal passes through. This is therefore a modification of the simultaneous method. One hundred and sixteen (116) c.c. of serum (10 c.c. per 600 lbs. body weight for plains cattle) were found to protect a plains animal, 348 lbs. body weight for a year, whereas Rogers found that a hill bull, 200 lbs. body weight, which received 300 c.c. of serum (actual) was highly susceptible after a period of less than three months and succumbed to severe rinderpest.

(*iv*) *Massive simultaneous.*

This method consists in injecting the animal on one side of the body with sufficient serum to confer protection by the serum alone method to be followed immediately by a large or massive dose of virulent rinderpest blood varying from 1,000 or 1,500 c.c. up to 5 or 6,000 c.c. on the other side. This method is only utilized when it is necessary to produce anti-rinderpest serum with the utmost dispatch and thus time (3 weeks) may be saved by omitting the protection of the animal in the first instance by the simultaneous method before giving a large dose of virulent blood. This system, however, cannot be recommended except in cases of emergency.

(*v*) *Defibrinated blood.*

The actions of defibrinated blood and serum are similar. The former acts on account of the serum contained in it, and if the animals used for producing the blood are highly fortified, then the defibrinated blood will be proportionally powerful. The disadvantages and the one advantage as detailed by Kolle and Turner are as follows :—

1. The quantity of blood required.
2. A great number of animals are requisite to immunize the cattle in great numbers.
3. Blood itself can communicate other diseases.
4. (*a*) The defibrinated blood will not keep.
   (*b*) The blood therefore cannot be tested as to its strength.

(*c*) Method of great service when no serum procurable, early carried out.

(*vi*) *Various methods of producing a resistance in cattle against rinderpest without utilizing the "causal agents" of such disease.*

(*a*) *Normal bile method* (*Lingard's*).—Susceptible plains cattle, injected subcutaneously with successive doses of fresh normal bile (six doses of 20 c.c.) collected from healthy plains bovines, were found to possess a resistance against inoculated rinderpest about ten days after the last injection. The resistance conferred in the first instance is of a *passive* character. The immunizing quality of normal bile probably depends upon the quantity of nucleo-albumin present in each sample of bile, and this varies considerably in different samples. Bile injected animals, when retested with virulent rinderpest blood after a period of 174 days, presented different results, according to whether a reaction had or had not occurred in the first instance. If a thermal reaction took place, it sufficed to confer a somewhat prolonged and *active* immunity to the animal, and no reaction would follow the second inoculation; whereas in the case of animals which failed previously to react to the first inoculation of virulent blood, death followed the second inoculation, since the immunity conferred was only of an evanescent character and consequently of short duration.

Resistance to rinderpest conferred by injection of substances prepared from certain animal and vegetable products.—In certain countries in Europe and other Continents, rinderpest is not endemic, and makes only its appearance at long intervals and then only when circumstances favour its introduction from a distance. A question of the utmost importance to such countries is, can any method or methods be adopted for the protection of cattle against rinderpest, in the absence of anti-rinderpest serum (either in the fluid or in the form of a powder) without resorting to the use of the "causal agents," the virulent *materies morbi* of such disease? The serious visitation of rinderpest to Great Britain in 1867 need not have come as a "thunderbolt" on the country, for the disease appeared in Russia two years previously and was studied by experts sent from Great Britain. Consequently, ample time was afforded in that instance for the preparation of some prophylactic at home, had such a preparation been forthcoming, or for securing anti-rinderpest serum from a country where the disease was enzootic, had it then been procurable. Since the above date, scientific methods have made great advancement, and we are in a position to prepare and have ready at an emergency certain animal and vegetable products and sera derived therefrom. These products in case of need have been found capable, in this country, of conferring on the most susceptible cattle a passive resistance for a short period of weeks, or of an active nature for a more prolonged interval, when virulent material in the form of rinderpest blood may be utilized by the simultaneous method, the agents being introduced on different sides of the body of the animal operated on. With such an end in view, the following methods, the results of some of the experiments conducted at Muktesar during the years 1900-03, have been introduced in this report. A further point of considerable interest is that the sera prepared from the testes of bovines and the seeds of pumpkins not only have the power, when injected subcutaneously or intravenously into susceptible animals, of conferring a passive resistance for a period against rinderpest only, but they possess "polyvalent" properties and grant a resistance to animals inoculated with rinderpest in the first instance, followed by virulent anthrax; and against rinderpest followed or preceded by Hæmorrhagic Septicæmia, respectively.

In a series of experiments undertaken to obtain protective extracts from organic substances, such as milk, yolk of egg, fish sperm and spawn cell protoplasm, mucin, vegetable seeds and yeasts, the best results were obtained by experimenting with the testes of cattle and the seeds of plants.

(*b*) *Testes.**—The testes of bovine and buffaloes were minced and an aqueous solution was extracted from them. The precipitate was collected and washed thoroughly, it was then dissolved in a

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* Resistance against rinderpest and other infectious diseases conferred by the subcutaneous injection of certain bile products and also by the injection of substances prepared from animal testes and the seeds of plants." "Centralblatt für Bakt. I Abt. Originale Bd. XXXVII. Heft 2" by A. Lingard, M.B., M.S., D.P.H., etc.

1 per cent. sodium carbonate solution and reprecipitated with acetic acid; this process was continued until the preparation was fairly pure. It was then finally re-dissolved in sodium carbonate solution and on the addition of chloroform, for the purpose of keeping, was ready for use for injection into cattle. Hill cattle, the most susceptible bovines in India to the disease, received no protection against virulent rinderpest blood when they were injected subcutaneously with large doses of this solution; whereas in the case of plains cattle, a marked resistance was conferred thereby. On the other hand, the serum of plains cattle, which had been repeatedly treated with the precipitate obtained from testes, conferred on hill cattle resistance to virulent rinderpest blood.

(*c*) *Vegetable seeds.**—Pumpkin seeds, outer coats removed, were ground and the oil expressed. A solution in sodium carbonate was then made, which was filtered and a precipitate collected, after the addition of acetic acid. The precipitate was obtained fairly pure after repeated solution and precipitation, and was finally made soluble in a 1 per cent. solution of sodium carbonate. Similar experiments were then conducted as under (*b*) testes, with somewhat similar results. In addition, this serum was found capable of bringing about a resistance against Anthrax and Hæmorrhagic Septicæmia, when animals were first injected subcutaneously or intravenously with certain quantities of this serum and at a later date (30 minutes to some days) with Anthrax and Hæmorrhagic Septicæmia cultures respectively.

Section II.—PREPARATION OF ANTI-RINDERPEST SERUM.

Before the preparation of anti-rinderpest serum in any country can be entertained (at all events upon a large scale), it is first necessary to have a fairly accurate knowledge on many points connected with the country of adoption and the animals which have to be utilized in the different processes.

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* *Vide* footnote on preceding page.

1. *With regard to the country in which it is desired to prepare serum.*—Perhaps the most important point to be enquired into in the first instance is with regard to temperature, for it bears upon the health of the animals to be dealt with, and also upon the value of the serum which has to be prepared, stored and afterwards issued.

When the temperature is a tropical or sub-tropical one, not only does the health of the injected animals suffer, as a consequence, but they are exposed to various virulent diseases which may greatly interfere with the course of proposed action and in some instances may bring about failure of what otherwise might have been a great success in a cooler climate.

In addition, in a tropical country with high temperature, the difficulties of keeping every article used in the various processes sterile is a source of much embarrassment. Without cool rooms or ice houses can be entertained, it will be somewhat difficult to keep a stock of serum in hand, as temperatures between 90 and 100° F. have a detrimental effect upon the protective value of sera when they are exposed to it for long periods.

2. *Animals (bovines, etc.) which have to be utilized in the different processes of serum preparation.*—Rinderpest is for the most part a disease of cattle, bovines and buffaloes, although certain other species of animals are more or less susceptible to the disease ; it is, however, mainly to these two species that we must turn our attention.

3. *Susceptibility.*—If the preparation of serum has to be confined to countries where all bovines and buffaloes are equally and fully susceptible to rinderpest, the question is very much simplified, for any selected animals can be submitted to certain methods of bringing about immunity and the "salted" animals once obtained, the susceptible animals furnish the necessary virulent blood.

But this is not the case in India. The cattle and buffaloes of the plains show varying degrees of immunity, so much so that especially in the United Provinces it would be impossible to utilize them for supplying virulent blood or for the purpose of testing the protective value of sera where a marked susceptibility is necessary in the animals utilized.

Hill cattle, buffaloes, goats and sheep indigenous to the tracts lying between the snow mountains and the outer Himalayas are more susceptible than the same species of plains animals respectively. Of imported animals (English, Aden and Persian) found principally in the Bombay Presidency, those attacked with rinderpest during recent years have all succumbed, whilst the percentage mortality amongst Sind bovines introduced into India amounts to 80 per cent. The hill breed are reported to be the most susceptible of those indigenous to India. As a rule, over 90 per cent. and sometimes cent. per cent. succumb to rinderpest in some outbreaks or when inoculated with virulent material. Consequently, in this country, the requirements necessary for a suitable locality for the establishment of a laboratory and depôt for the preparation of rinderpest and other sera includes the following :—

> The selected spot must be situated in British territory, for obvious reasons, near or within easy reach of the home of the most susceptible breed of cattle, large numbers of which are required to furnish virulent blood, a large tract required, which can be increased from time to time, as necessity arises, to allow of the isolation and segregation of different herds of cattle, and cultivation of the required fodder, etc. Further, the best meteorological conditions including temperature and rainfall are a *sine qua non,* and must be present at the selected site, in order to provide for the welfare of the animals utilized, the protection of the processes and the products, and the well-being of the people engaged in such trying work.

Does the situation of the Muktesar Estate meet with the above requirements ? Yes. It is situated in British territory, about 4 miles from the main trunk road, within 25 miles of the plains, and 75 to 100 miles of the centre of the hill cattle district, area of the estate being 7 square miles which can be extended, in case of necessity, at an elevation varying from 5,800 to 7,500 feet above sea-level, temperature varying from a few degrees below 32° in January to a maximum of 86° F. in the shade in May.

Rainfall is about 50 inches in comparison with 125 inches on the outer Himalayas, 13 miles distant in a southerly direction.

4. *With regard to the arrangements for the reception, protection and utilization of cattle in the preparation of sera on the Muktesar Estate.*—The animals have to pass through the following routine:—

(*a*) Segregation on the western outskirts of estate for 14 days.
(*b*) Brought to healthy kraal.
(*c*) Drafted to main laboratory for preparation of virulent blood or serum or testing as required.
(*d*) When finished with, segregated again for ten days.
(*e*) Drafted to second kraal in the east.
(*f*) Later sold or used as plough bulls on the estate.

5. *Animals utilized.*—Plains and hill bovines and buffaloes from the two regions have been utilized for the most part during the course of the research for furnishing a hyper-immunized serum, but minor experiments have been carried out with goats, sheep, equines and dogs, but as all of the last mentioned with the exception of equines, which are insusceptible to rinderpest, are small and the quantity of serum to be obtained unremunerative, the preparation of sera from them is impracticable.

6. *Methods of bringing about a primary immunity.*—The different methods in vogue have already been mentioned in Section I.

7. *Materials used to inoculate.*—For the most part virulent blood has been obtained from hill bovines, although in the course of the experiments, plains bovines have been injected with virulent blood obtained from plains animals, and plains buffaloes have been injected with virulent blood from plains and hill buffaloes, but as the cost was reduced and the protective value of the serum identical or better in the latter injection, plains and hill buffaloes have been of late injected with the blood of hill bulls.

8. *Decrease in virulence, when rinderpest is passed from animal to animal through a long series of hill cattle.*—The extreme importance of pursuing investigations with regard to rinderpest and other diseases with material obtained from the most virulent source has been insisted upon by me for many years past. For

sera prepared from moderately virulent material, results in the production of a protective agent only powerful enough to immunize animals from a mild form of the disease, or requiring much enhanced doses of the same serum to combat a more severe form of the malady. It has been found that in trying to obtain a *virus fixe*, by passing a virulent strain of rinderpest blood obtained from the hill breed of cattle—which but seldom exhibit any hereditary or acquired immunity—that although the incubation period of the disease decreases after a time in an uncertain percentage of animals from 3½ to 2½ days, while concurrently other symptoms point to the fact that the virus possessed the same or more virulent qualities. Nevertheless, when the protective power was tested upon hill cattle by the simultaneous method and a fresh strain of hill blood from a recent epizootic utilized for the purpose, the immunizing power of the serum, prepared from the series of passages, was found incapable of protecting that species against the more recent strain of virulent blood at the standardized or even double the dose.

In fact, the first strain of blood had lost considerably in virulence and it required 3½ times the amount of serum to combat the effect of the virulent strain.

With regard to the cause of the deterioration in protective power, attention must always be directed to ascertaining that no secondary diseases occur in the successive animals inoculated with virulent blood as for instance, Piroplasmosis, or Trypanosomiasis. These complications which have been observed at Muktesar may, in certain instances, be present without symptoms of the second form or forms of the disease being recognizable, other than an erratic temperature quite characteristic of Piroplasmosis, but not observed in uncomplicated rinderpest.

9. *Methods utilized :—*

(*a*) *Slow method.*—The primary method utilized in the process of preparing a hyper-immunized anti-rinderpest serum, termed the "slow method," consisted of repeated and successive doses of virulent blood at intervals, at first small and later gradually increasing in amount, given to an animal already protected against the disease. When doses of 50, 100, 250, 500, 750, and 1,000 c.c. had been administered at intervals allowing the respective reactions to pass off before the next doses were injected, the animal was bled for the first time. Before the first blood could be drawn, a period of 90 days frequently elapsed, and before a second bleeding could be effected, a further single dose of 1,500 or 2,000 c.c. of virulent blood had to be injected and a further interval allowed to elapse. This procedure was continued until large doses of 5,000 to 8,000 c.c. of virulent blood were administered at one time.

By adopting the above mode of procedure it was anticipated that the longer the animal was submitted to the course of increasing doses of virulent blood so the protective value of the serum prepared would also increase. This relationship, however, between the amount of virulent blood injected and the protective value of serum was not always found to result.

(*b*) *Rapid method.*—The rapid method, introduced in order to minimize the time and cost necessary in the production of a serum of high protective value, consists of simply injecting one large dose of defibrinated blood subcutaneously into an animal which has previously been immunized, and waiting for a period of 14 days after the reaction, which follows, has terminated. If the reaction lasted eight days, bleeding would be performed for the first time on the 22nd day after the injection of virulent blood. By this method an animal injected in the first instance would be in a position to furnish a protective serum in a minimum period of 32 to 36 days.

(*c*) *Modified rapid method.*—A modification of the rapid method was introduced with a view to still further reduce the interval between the primary injection and bleeding, *viz.*, the introduction of serum on one side of the animal and a massive dose of virulent blood on the other, thus doing away with the time necessary to bring about a primary protection before giving virulent blood in large doses. By this method serum could be furnished by an unprotected animal in from 21 to 25 days.

A second modification was tried in order, if possible, to bring about a still quicker method of preparing hyper-immunized serum. A protected animal was bled in the first place to 2,000 c.c. and within an hour the blood of a 2nd animal (presenting the necessary symptoms of rinderpest) was directly pumped into the vein of the first-mentioned animal. This method was found unsatisfactory, for the injected animal frequently presented pulmonary complications and was rendered unfit for the supply of serum.

Under the following headings, of plains and hills bovines and buffaloes, have been grouped short accounts concerning the various methods utilized in bringing about protection and the production of hyper-immunized sera by the slow and rapid methods, together with the protective values per 600 lbs. body weight for hill animals, of the sera furnished. The protective values for the plains being $\frac{1}{15}$ to $\frac{1}{18}$ of that recorded for the hill species.

It should be remembered that the above protective values are the results of the test experiments carried out with the sera obtained from the first bleedings.

The detailed table of each breed of animal will be found in the Appendices.

Plains Bovines.

Laboratory No. of bulls.	Age.	By what method immunized.	Quantity of virulent blood injected.	By what method injected. Slow or Rapid.	Protective value of serum per 600 lbs. body weight for hill bulls.	REMARKS.
	years.		c.c.		c.c.	
261	3	S. A.	4,400	Rapid.	250	Tested with virulent blood, injection of one massive dose of virulent blood.
932	1½	With 1 c. c. V. B.	6,000	"	175	Inoculated with virulent blood followed by one massive injection of virulent blood.
1281	3	"	6,350	"	180	
927	1½	S. M.	5,350	"	250	S. M. followed by one massive injection of V. B.
934	3	"	5,750	"	60	
286	3	"	6,000	"	30	
652	4½	"	6,000	"	30	
930	3	"	9,000	"	40	

Plains Bovines— contd.

Laboratory No. of bulls.	Age.	By what method immunized.	Quantity of virolent blood injected.	By what method injected Slow or Rapid.	Protective value of serum per 600 lbs body weight for hill bulls.	REMARKS.
	Years.		c.c.		c.c.	
339	4	S. M.	5,450	Rapid.	45	S. M. after interval tested with V B. followed by one massive dose of V. B.
644	3¼	,,	5,100	,,	125	
534	...	,,	6,900	,,	40	
846	4	,,	4,000	,,	50	S. M. (serum one side the body, massive dose on the other).
942	3	,,	5,000	,,	135	
281	2	S. A.	3,000 9,000	,,	275	Serum alone, interval, V. B., interval, 2 massive doses.
926	2	S. M.	1,600 3,400	,,	over 350	S. M. followed by 2 massive doses of V. B. at intervals.
718	over 5	,,	4,200 1 800	,,	60	S. M., interval, tested V. B., followed by 2 massive doses V. B.
331	4	,,	6,700 3,300	,,	?	
1271	6	,,	1,000 5,200	,,	135	Massive S. M. followed by second massive injection.
1273	4	,,	3,900 4,500	,,	180	
1295	over 7	,,	4,200 1,700	,,	over 300	

N.B.—S. A.=Serum alone method.
S. M.=Simultaneous method.
V. B.=Virulent blood.

Hil Bovines.

Laboratory No. of bulls.	Age.	By what method immunized.	Quantity of virulent blood injected.	By what method injected. Rapid or Slow.	Protective value of serum per 600 lbs. of body weight for hill bulls.	REMARKS.
	Years.		c.c.		c.c.	
77	6	S M.	10+100+250 +500+1,000	Slow	120	S. M. followed at intervals by gradual increasing doses.
460	5	"	10+1,000+ 3,500+6,000	"	45	
1168	8	"	4,000	Rapid	125	S. M., bled, injected with massive dose V. B.
1000	3½	"	3,220	"	40	S. M. followed by one injection V. B.
1236	6	"	3,300	"	50	
1001	2	"	3,400	"	60	
451	6	"	4,600	"	15	S.M., re-tested V. B. after 220—246 days, followed by one large injection of V. B.
500	3	"	7,700	"	120	
352	6	"	3,000	After 3 bleedings injected 3,300 c.c. in each. "	250 10	S. M. followed by two injections V. B., three bleedings between first and second doses V. B.
900	6	"	3.000	"	30 15	
960	3	"	2,000 2,500	Rapid	10	S. M. followed by two injections of V. B., second larger than the first.
1039	4	"	1,700 3,300	"	250	
992	3	"	2,500 2,600	"	180	
991	4½	"	1,900 4,100	"	45	
729	2	"	2,650 4,165	"	70	

Hill Bovines—continued.

Laboratory No. of bulls.	Age.	By what method immunized.	Quantity of virulent blood injected.	By what method injected. Rapid or Slow.	Protective value of serum per 600 lbs. of body weight for hill bulls.	REMARKS.
	Years.		c.c		c.c.	
560	3	S. M.	2,800 4,700	Rapid	75	S. M. followed by two injections of V. B. second larger than the first.
704	Aged	„	4,350 6,450	„	20	
1116	6½	„ (Massive)	3,500 and serum	„	300 insufficient, death.	Massive, S. M.
1080	over 5	S. M.	1,850 and serum + 2,150	„	80	Massive S. M. followed by large dose of V. B.
1081	5	„	1,850 and serum + 2,150	„	135	
1225	5	(Massive)	1,350 and serum + 3,000	„	135	

Buffaloes.

Laboratory No. of buffaloes.	Age.	By what method immunized.	Quantity of V. B. injected.	By what method injected. Rapid or Slow.	Protective value of serum per 600 lbs. of body weight for hill animals.	REMARKS.
	Years.		c.c.		c.c.	
1	5	S. M.	500+1,000	Slow	80	S. M. followed at intervals with increasing doses of buffalo V. B.
2	7	„	6,000	Rapid	30	S. M. followed by one injection V. B. (buffalo).
60	2	„	6,000	„	52	
40	1	„	5,200 (hill blood)	„	100	Protected with 10 c.c. V. B. followed at intervals by one injection V. B. (hill bovine controls).
33	4	„ (Massive)	3,560 (buffalo + hill blood) + 200 c.c. serum + 2,650 (buffalo blood) + 5,190 (buffalo blood).	„	50	Massive S. M. injection of V. B. and serum followed at intervals by two more injections of V. B.

Section III.—PROTECTIVE VALUE OR STRENGTH OF SERUM.

The blood of healthy animals frequently possesses a certain, but varying, degree of bactericidal power. It was therefore essential that previous to making experiments to ascertain the protective value, if any existed in the blood of different animals, during the course of and at the termination of an attack of rinderpest, a unit should be determined for that of the normal animals utilized. In a country where all or a large percentage of the animals attacked with rinderpest succumb to the disease, the protective power of the serum must be so slight that it need hardly be taken into account, but it is well known that some plains animals in this country may pass through attacks of rinderpest of so slight a character that it may even be overlooked by the initiated in this disease. In this latter class of animals the protective power of the serum must be appreciable.

In the following tables, under their respective headings, will be found the protective values of rinderpest sera from so-called healthy animals, and from those which exhibited rinderpest on different days of the disease. All tests were conducted by the inoculation of varying quantities of serum by the simultaneous method on hill animals, the most susceptible breed of bovines indigenous to India.

It may be here stated that it has been ascertained by repeated experiments that the plains cattle of the United Provinces require a dose 15 to 18 times less than that required by the small hill animals per 600 lbs. body weight.

The protective power of the blood serum of plains and hill animals under different conditions when tested by inoculation of varying quantities by the simultaneous method on hill animals.

I. PLAINS BOVINES.

(i) *Normal Serum (healthy animals).*

(*a*) The serum of No. 406—2,261 c.c. per 600 lbs. insufficient to grant protection to hill bulls.

(*b*) The serum of No. 407—1,500 c.c. per 600 lbs. sufficient to grant protection to hill bulls.

(ii) Animals which had passed through an attack of inoculated rinderpest.

(*a*) The serum of No. 406 (18 days after inoculation)—700 c.c. per 600 lbs. sufficient to grant protection to hill bulls.

(*b*) The serum of No. 1278 (29 days after inoculation)—580 c.c. per 600 lbs. sufficient to grant protection to hill bulls.

(iii) Animals which had passed through a modified attack of rinderpest, after inoculation by the simultaneous method.

(*a*) No. 411 (2·92 c.c. serum + 1 c.c. V. B.) bled 27th day following inoculation. Dose 250 c.c. per 600 lbs. hills.

(*b*) No. 347 (3·54 c.c. serum + 1 c.c. V. B.) bled 20th day following inoculation. Dose 250 c.c. per 600 lbs. hills.

(iv) The protective value, if any, of serum from a plains bull injected with 6,000 c.c. of healthy or normal blood from hill bulls.

No. 2147—6,000 c.c. subcutaneously injected—1,500 c.c. per 600 lbs. insufficient to protect hill bulls.

II. Hill Bovines.

(*i*) *Healthy animals.*

The serum of hill bulls—Too large a quantity to inject, the dose would be 15 to 18 times that required for protective plains bulls.

(ii) Animals which have passed through an attack of inoculated rinderpest.

(*a*) The serum of No. 368 (9th day following inoculation)—reaction lasted seven days, just before death. 1,150 c.c. insufficient to grant protection to hills.

(*b*) The serum of No. 488 (14th day after thermal reaction terminated)—250 c.c. sufficient to grant protection to hills.

(iii) Animals which have passed through a modified attack of rinderpest, after inoculation by the simultaneous method.

(*a*) No. 1167 (318· c.c. serum + 0·5 c.c. V. B.) bled 13th day following inoculation—Dose 200 c.c. per 600 lbs. for hills.

(*b*) No. 1159 (88·75 c.c. serum + 0·5 c.c. V. B.) bled 20th day following inoculation—Dose 100 c.c. per 600 lbs. for hills.

(*c*) No. 1339 (54·33 c.c. serum + 0·5 c.c. V. B.) bled 26th day following inoculation—Dose 120 c.c. per 600 lbs. for hills.

(*d*) No. 1334 (20·00 c.c. serum + 0·5 c.c. V. B.) bled 26th day following inoculation—Dose 110 c.c. per 600 lbs. for hills.

(*e*) No. 794 (38·70 c.c. serum + 0·5 c.c. V. B.) bled 28th day following inoculation—Dose 40 c.c. per 600 lbs. for hills.

(*f*) No. 1342 (23·55 c.c. serum + 0·5 c.c. V. B.) bled 33rd day following inoculation—Dose 100 c.c. per 600 lbs. for hills.

(*g*) No. 1354 (36·40 c.c. serum + 0·5 c.c. V. B.) bled 33rd day following inoculation—Dose 90 c.c. per 600 lbs. for hills.

(*h*) No. 1168 (19·00 c.c. serum +0·5 c.c. V B.) bled 32nd day following inoculation—Dose 90 c.c. per 600 lbs. for hills.

(*iv*) *Animals which had passed through a modified attack of rinderpest, after inoculation by the simultaneous method, and were later injected with varying doses of virulent blood.*

(*a*) No. 1113 (30·83 c.c. serum + 0·5 c.c. V. B.) 18th day following inoculation injected 500 c.c. V. B. bled 39th day following S. M.—Dose 120 c.c. per 600 lbs. body weight for hills.

(*b*) No. 1114 (81·50 c.c. serum + 0·5 c.c. V. B.) 16th day following inoculation injected 1,000 c.c. V. B. bled 37th day following S. M.—Dose 90 c.c. per 600 lbs. body weight for hills.

(*c*) No. 1112 (64·60 c.c. serum + 0·5 c.c. V. B.) 18th day following inoculation injected (2,000 c.c. V. B.) bled 39th day following S. M.—Dose 700 c.c. per 600 lbs. body weight for hills.

Before drawing any deductions from the effects produced on plains animals, by periodical bleedings after subcutaneous injections of varying quantities of virulent rinderpest blood, it was necessary to submit a healthy animal of the same breed to a number of bleedings for the sake of comparison.

The animal selected (No. 1274) was a plains bull of mixed breed age 5 years, body weight 331 lbs., obtained from Baheri in the Terai at the commencement of 1902.

During a period of a little over a year, twenty-one bleedings were performed from the jugular vein, 1,000 to 2,500 c.c. being drawn on each occasion. At first, intervals of a week to a fortnight were allowed to intervene between the first 18 operations, then an interval of six months elapsed before the final bleedings. The body weight increased during the period of observation from 331 to 542 lbs., an increase of 63·74 per cent. upon the initial weight. The percentage of fibrine in the blood varied on different occasions from 8·1 to 18·6; that of the serum from 31·00 to 61·00. The specific gravity of the serum from 1022·25 to 1028·00 and the total proteids in the serum from 7·1120 to 9·0800 grammes per cent.

Section IV.—PERIOD DURING WHICH ANTI-RINDERPEST SERUM HAS BEEN FOUND TO RETAIN ITS PROTECTIVE POWER AFTER EXPOSURE TO VARYING TEMPERATURES.

Hills.—At Muktesar the sera kept for long periods (two years) through the hot and cold seasons, do not deteriorate in their protective values. All sera are kept in a cold room excavated in the face of the rock and protected by double doors. During the hot season (May to the end of June) the cool air is allowed to circulate through the room during the coolest hours of the night and early morning.

Plains.—Experiments were undertaken to prove whether sera will retain their initial protective power in the plains of India, when exposed to the maximum shade temperature in the localities, in which depôts for the reception of serum have to be located.

Jacobabad (Sindh).—Two samples of the anti-rinderpest sera, *viz.*, Nos. VII and VIII, were deposited in the office of the Collector of Jacobabad on the 17th January and retained there until the end of July 1901. During this interval the following maximum shade temperature readings were recorded:—

January	78·4° F.
February	89·5° F.

March	107·4° F.
April	112·2° F.
May	123·0° F.
June	125·0° F.
July	126·0° F.

On being re-tested, these sera were found to have lost 40 and 66·6 per cent. respectively in protective power, as compared with the standardized dose registered when issued.

Madras.—A sample of No. VII serum was found to have lost 55 per cent. in protective power when it was deposited in Madras between 20th August 1900 and 18th November 1901, the maximum shade temperature rising to 108·5° F.

Meerut.—A sample of No. VIII serum was deposited in the Civil Veterinary Department Office in Meerut, between 26th November 1900 and 27th January 1903, having been exposed for a period of 26 months, including 2 hot seasons, maximum shade temperatures rising to 107·7° F. and 103·8° F. respectively. When tested, it was found to have lost 55 per cent. in protective power compared with the standardized dose when issued from Muktesar.

Other samples of sera have been found to retain their protective values when exposed during several months to maximum shade temperatures of 90·0° F. Consequently, experiments have been carried out to determine at what depth pits will have to be dug in the ground, at the different localities where serum has to be located in depôts, in order to guard against a higher temperature than 90·0° F. being recorded during the hottest season. By this means the expense and trouble of keeping an ice refrigerator will be done away with.

Section V.—SUSCEPTIBILITY OF BOVINES AND BUFFALOES, ETC., INDIGENOUS TO INDIA.

(Plains cattle and buffaloes as distinct from hill cattle and buffaloes.)

The animals of the Himalayan or "hill" regions are more susceptible to rinderpest than any of the animals of the plains of India as far as is known.

Hill cattle, buffaloes, goats and sheep are more susceptible to rinderpest than the same species of *plains* animals respectively. The hill breed of cattle are reputed to be the most susceptible of those indigenous to India. As a rule, over 90 per cent. and sometimes cent. per cent. succumb to rinderpest in some outbreaks or when inoculated with virulent material. This breed of cattle requires from 15 to 18 times the quantity of protective serum per 600 lbs. body weight as compared with Indian plains breed of cattle obtained from the Bhabar and Tarai districts (United Provinces).

Half-bred animals.—The progeny of "hills" and "plains" required doses of serum approximating to those necessary for hill cattle, *viz.*, from 15 to 18 times the dose given to plains. The half-bred cattle are not so susceptible to rinderpest as "hills," but as it is impossible to compute the degree of susceptibility, in order to be on the safe side, the full dose for hill animals should be administered.

Plains sheep rarely succumb to an attack of rinderpest, whilst all Thibetan sheep brought over the Himalayas to the Muktesar Laboratory by Bhotias have succumbed to the inoculated disease.

Hill-buffaloes.—From the point of view of susceptibility to rinderpest, this breed, although much smaller than plains, occupies a position between hill and plains cattle, but more closely allied to the former.

Section VI.—SIZE OF ANIMALS IN INDIA.

Plains bovines, hill bovines, buffaloes (plains), buffaloes (hill).

The plains animals of India vary in size enormously from the small trotting bullocks so commonly seen in the Madras and Bombay Presidencies to the siege train bullocks, etc. The former vary from 100 to 150 lbs. in weight, while the latter scale up to 2,000 lbs. The animals of *mixed breeds* so commonly found in the United Provinces and Oudh seldom exceed 500 lbs. in body weight, while the majority when full grown seldom average more than 350 lbs. Hill breeds, Kumaon and pure bred Chaugarkha and Gangoli animals, are of smaller size. Cross bred, Gangnâli, are of larger size.

The following figures give the minimum, maximum and average weights of animals scaled from different districts :—

District.	Maximum.	Minimum.	Mean.	Remarks.
	lbs.	lbs.	lbs.	Bulls.
Bareilly (Tahsil Baheri)	562	263	367	50
Lucknow	400	221	276·6	25
Jalaun	347	203	284·8	25
Meerut	447	233	318·8	25
Moradabad	503	222	321	45
Bhabar	482	205	276	75
		(Central Provinces)		
Nagpur	632	283	441	22

Hill bovines.

The hill breeds include two, the smaller size called Chaugarkha or Gangoli (pure) and the larger size named Gangnáli (cross-bred). The smaller variety seldom exceeds 250 lbs. body weight, while the larger attains to 350 lbs. Taking 300 hill bulls of both classes, the weight by scale were as follows :—

Maximum	315 lbs.
Minimum	110 lbs.
Average	182 lbs.

Buffaloes.—Plains buffaloes attain to considerable proportions ; it is not uncommon to find animals weighing between 1,100 and 1,200 lbs. body weight. On the other hand, hill buffaloes of the same age frequently scale but half as much as the latter, when they are bred and matured in mountain districts.

Section VII.—QUESTIONS CONCERNING PRACTICAL POINTS CONNECTED WITH THE PREPARATION OF SERUM AND INOCULATION OF RINDERPEST ANIMALS.

(i) Difficulty of furnishing virulent blood for use in inoculation at a distance either for simultaneous method or for control animals.

The greatest difficulty has been experienced on numerous occasions of obtaining virulent blood for the purpose of the simultaneous method or for controls for testing animals which have been treated previously by the serum alone method, in stations in the plains; the distances are so great that without a good supply of ice, it is hopeless to reach a station far from Muktesar with blood in a condition to reproduce a severe form of disease.*

Sheep have been utilized by us in this country as recommended by Koch, but the expense and poor accommodation on the trains renders this mode of procedure undesirable. With a view to discover a virulent fluid in a small compass, and one that could be kept during long periods and transported from place to place in ice when necessary, a number of experiments were carried out in 1901-02 with the different body fluids of hill cattle collected aseptically *in vitro*. Peritoneal fluid, removed from animals which had just succumbed to rinderpest on the 7th day of disease, was collected in sterilized glass vessels and had immediately added to it $\frac{1}{2}$ per cent. of carbolic solution. Fifty-four days after collection, when 250 c.c. were injected subcutaneously into a hill bull, death took place from well-marked rinderpest.

The following experiments were carried out with the peritoneal fluid drawn from No. 1361, age 2 years (204 lbs.) hill bull (inoculated rinderpest) on the 4th day of the disease and 6th day after inoculation:—

No. of hill bull.	Age.	Date of inoculation.	Quantity of fluid injected.	Date of death.	Number of days after death that fluid was used.
	Years.		c.c.		
1421	3	29th April 1901	50	9th May 1901	17
1426	$4\frac{3}{4}$	Ditto	100	Ditto	17
1424	3	Ditto	150	7th May 1901	17
1507	5	4th June 1901	250	19th June 1901	54
1450	$3\frac{3}{4}$	...	1 c.c. V. B. from 1426.		...

Succumbed to severe form of rinderpest All symptoms. Death.

(ii) Preparation of serum for use in protecting hill cattle.

As full grown hill cattle vary in body weight between 110 and 315 lbs. and as they require by the simultaneous method a dose of

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* *Bone marrow from rinderpest animals* can be utilized to reproduce the disease in susceptible animals. It can be kept for a considerable period and transported to long distances if preserved intact in the bone and kept on ice.

15 to 18 times the quantity of serum found necessary to protect plains cattle from the Terai and Bhabar, *viz.*, 180 c.c. per 600 lbs. body weight of a serum estimated at 10 c.c. for plains, it is more convenient to utilize a serum with a high protective value in order to minimize the dose necessary to inject such small animals, for the following reasons :—

(*i*) native owners get frightened when prominent tumours supervene after injections of serum,

(*ii*) the syringes generally used in the field do not exceed 20 c.c. capacity, consequently large doses require repeated chargings of the instrument.

It is therefore desirable when large numbers of hill cattle have to be protected that serum of high protective value should be utilized, and for this purpose, when necessary, the serum from first bleedings of high protective value can be specially set aside, and later tested in bulk for this purpose.

(iii) What is the maximum quantity of blood that can be drawn at one operation without exposing the life of the animal to great risk ?

If it is desired to obtain a large quantity of blood from any bovine without running undue risk of life, it has been found that, as a rule, an animal can at Muktesar (elevation 7,500 feet above sea-level) be bled a quantity equivalent in cubic centimetres to ten times the number of pounds the animal weighs. So that a plains animal weighing 430 lbs. could be bled 4,300 c.c. at one time without producing, in the great majority of instances, any inconvenience, while in the minority, not more than temporary faintness, which soon passes off.

(iv) Question of raising the protective value of a large quantity of serum of low protective power.

For practical purposes, it has been found that a serum the protective value of which for plains animals is between 5 and 10 c.c., by the simultaneous method, is one most easily handled in the field. The protective value of a given large quantity of serum collected from a number of different animals, plains and hills, each of which have been bled some 12 times or more, will frequently be found of low strength and if issued at such a standard would require enhanced doses to bring about the necessary protection. For this purpose, it has been found advisable to inoculate a number of hill bulls by the simultaneous method and after allowing a period of 28 to 33 days to elapse, to bleed these animals to the utmost limit, and add the resultant serum of all first bleedings to the general output. By this means the protective value of the large volume of serum may be raised according to the quantity and quality of serum added from first bleedings.

(V) Spontaneous diseases met with at Muktesar or Bareilly in plains or hill animals, bovines and buffaloes, used in the preparation of anti-rinderpest serum.

(i) *Foot and Mouth disease.*—This disease is very common during the months *October to April* in the hills and is usually brought down from the snow mountains on the approach of winter by the *Bhotias* from their villages situated between 8 to 12,000 feet elevation. Associated with rinderpest this disease is usually fatal to bovines.

(ii) *Trypanosomiasis*—Was first met with in hill bulls used at Muktesar in June 1902, in conjunction with the Bacillus Anthracis and later in June and July 1904, by Holmes, in the same species of cattle.

(iii) *Piroplasmosis or Texas Fever.*—First observed at Bareilly in 1902, in plains bovines, during the course of inoculated rinderpest, 62 per cent. of red corpuscles were invaded by the *Piroplasma bigeminum,* most animals attacked succumbed. Hill animals inoculated, whose blood contained the smaller forms of Piroplasma, the "causal agent," proved refractory. A second form found present in nearly all animals and man during 1903-04 produced a few symptoms, but did not interfere with the course of inoculated rinderpest in hill cattle.

(iv) *Hæmorrhagic Septicæmia* appears at times spontaneously in an acute and in a semi-acute form, generally in fresh animals received from the cattle collectors, who obtain the animals from an extensive area between the Himalayas and the snow mountains.

(v) *Gastro-Enteritis.*—During the spring and hot seasons, and during seasons of grass famine, large numbers of cattle succumb to this malady, as the principal food during such periods consists mainly of the leaves of trees, including for the most part oak leaves which are spiny and ligneous.

(vi) *Malignant Œdema.*—This disease broke out during 1904, when bovines were accommodated in cattle sheds just constructed during the rainy season, the floors of which consisted of fresh rammed earth, the epizootic ceased when mud floors were replaced by stone ones.

(vii) *Nematode worms.*—In the great majority of plains bovines and buffaloes, embryo-filaria are present in the blood of the general and peripheral circulation. The parent worms are found lying under a thin layer of tissue on the inner surface of the aorta. These nematodes frequently form tumours, hemispherial in form, on the external surface of the large vessels in direct connection with the left side of the heart.*

(viii) *Spiroptera Scutata.*—Are occasionally found in the œsophagus of hill bulls, lying beneath the lining membrane. Their appearance is very characteristic in a close spiral form. On one occasion only, was this species of nematode discovered in the aorta of a plains bovine.

(ix) *Syngamus laryngis,* present in the larynx of bovines and buffaloes, specially those inhabiting pastures between the outer and inner Himalayas. Present either singly (male and female in intimate union) or in numbers up to twenty. Bright or dark red in colour. Much more numerous during certain months of the year (rains). *Vide* Annual Report 1897-98.

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* Observations on the filarial embryos found in the general circulation of the Equidæ and Bovidæ and their probable pathological significance. Fasiculus I, Barsati published by Adlard and Son, London.

(x) *Sarcosporidiæ.*—These bodies are of general frequency in the muscular structure of the hearts of hill bovines. In a series of 2,000 post-mortems, few, if any, animals failed to exhibit the curved and sausage-shaped bodies. Areas of a white or light brown colour are easily observed with the naked eye, and are nearly always detectible in the cavity of the L. ventricle of the heart.

(xi) *Rice bodies in œsophagus.*—A fairly common form of invasion is one observerd in the œsophagus of hill cattle. Curved or straight sauage-shaped bodies presenting a definite capsule, somewhat clear or may be white in colour, containing a gelatinous material resembling white of egg. These are found lying under the m.m. and are termed "rice bodies." This form appears to be the larva of some fly. Species as yet undetermined.

Section VIII.—CONCLUSIONS.

Some results to be drawn from experiments conducted at Muktesar.

I.—Plains.—(i) Of the different methods utilized, the best and most economical results were obtained by the "Rapid" process of injecting 6,000 c.c. of virulent rinderpest blood, at one operation into a protected plains animal, at varying intervals after immunity had been brought about by the simultaneous method. The first bleeding should be accomplished fifteen days after the subsidence of the reactionary fever due to the massive dose of blood, followed by eleven others each at intervals of seven full days. At the expiration of 78 days the animal is again injected with a similar or slightly increased amount of virulent blood, and a second series of bleedings instituted after the interval above prescribed.

(ii) When large doses of virulent rinderpest blood, above 6,000 c.c., are injected into plains cattle at one operation, a weak or attenuated serum usually results.

(iii) In some cases the serum collected from the first bleeding possesses the highest protective power, but in others it is the serum prepared from the first bleeding following the second massive injection of virulent blood. It seldom or ever happens, however, that the protective value of the serum of the bleeding after the third and increased massive dose of virulent blood equals that collected on the second occasion.

(iv) The protective value of a serum considerably depends upon the degree of severity of the initial attack of rinderpest, especially in plains animals, be it spontaneous, inoculated or a modified form of disease, which the animal has passed through previous to the injection of one or more massive doses of virulent blood.

(v) The protective power of a serum to be of practical value in this country should not require a larger dose than 180 c.c. per 600 lbs. body weight for hill animals, that is, 10 c.c. for plains animals as tested on Bhabar and Terai cattle.

(vi) Frequently a better reaction follows the injection of a massive dose of virulent blood, when the injected animal has been bled to 2,000 c.c. within a period of 2 to 24 hours previous to the operation.

(vii) Injections of more than 6,000 c.c. of virulent blood in the first instance appear to be unnecessary, at all events in the case of plains cattle. Injections of blood in excess of the above quantity do not appear to produce a corresponding increase in the protective value of the serum produced.

(viii) If two animals of the same breed be protected by the same method, and are afterwards subcutaneously injected with similar quantities of virulent blood, and are later, bled after like intervals, the serum produced by each animal respectively may, at the time of the first bleeding, possess equal protective values, but in subsequent bleedings the strength of the sera will not be identical. One may lose its power much more rapidly than the other.

(ix) Young bovines under two years and old animals over seven years of age, in the majority of instances, have been observed to yield a serum of lower protective value than animals of from 3 to 5 years of the same breed.

(x) A great loss in the protective value of a serum (83 to 89 per cent.) occurs spontaneously when a long interval (130 to 150 days) is allowed to elapse between the first and second bleedings of a highly immunized animal.

(xi) Sometimes the protective value of a serum in a young animal (2 years) decreases rapidly so that after a 5th bleeding—interval of 28 days from 1st bleeding—the serum will be found to possess but $\frac{1}{6}$ of its power as found after the 1st bleeding and this in the face of the animal increasing 40 lbs. in weight during the same period. (*Vide* case of hill bull No. 729, page 96.)

(xii) When a serum of high protective power in small bulk is required for protecting the most susceptible animals, it can be obtained from the first bleedings, after repeated injections. Such a serum would be collected from the respective serum giving animals mixed and tested as usual.

II.—*Hills.*—(i) Hill animals are, as a rule, only about half the weight of ordinary plains cattle. Unless the protective valne of the anti-rinderpest serum produced by this breed, after the injection of large doses of virulent blood, can be proportionately increased, it does not, from an economic point of view, pay to utilize hill bovines for continuous or a succession of bleedings, for only such a small quantity of serum can be collected from each.

(ii) Hill cattle inoculated by the simultaneous method will generally furnish a serum, after an interval of about 4 weeks' duration, of which the protective value will be found equivalent to a dose of 90 c.c. for hill and about 5 c.c. for plains per 600 lbs. body weight.

(iii) Large doses of virulent rinderpest blood subcutaneously inoculated into hill cattle, generally produce sera possessing higher protective values than those furnished by plains cattle with corresponding doses of virulent blood.

N.B.—Some of the above conclusions are alike applicable to plains and hill bovines and buffaloes.

(iv) Some aged hill bulls furnished sera of high protective values after one or more massive doses of virulent blood, previous to the first bleeding. The quantity of virulent blood required to bring about such results is excessive and renders the method from an economical point of view impracticable.

(v) Sera of somewhat low protective values are furnished by hill animals, which have received protection by the massive simultaneous method primarily, without previous protection being conferred by one of the ordinary methods.

(vi) Probably sera of the highest protective values are furnished by hill animals which are protected in the first instance by the serum simultaneous method, and later receive two (increasing) massive doses of virulent blood 2,000 and 2,500 c.c. on the 56th and 68th days after the primary inoculation. The first bleeding being effected on the 91st day. Under such conditions the serum has been found to possess a protective value of 10 c.c. per 600 lbs. for hills, equivalent to 0·55 c.c. per 600 lbs. for plains cattle from the Bhabar and Terai.

III.—*Buffaloes.*—(i) The expense of the necessary buffalo controls and the trouble and time occupied in collecting and injecting so much virulent blood on frequent occasions, does not sufficiently compensate one, by the production to a certainty, of a serum of high protective value.

(ii) Buffaloes inoculated with virulent blood derived from buffalo controls, furnish sera which will protect their own species, as also plains and hill bovines against rinderpest.

(iii) Buffaloes inoculated with virulent blood derived from hill controls will furnish sera capable of protecting buffaloes and plains and hill bovines against rinderpest.

(iv) Buffaloes inoculated with massive doses of virulent blood derived from buffalo and hill controls mixed, will furnish sera which will protect plains and hill bovines as well as their own species against rinderpest.

(v) In this country it has not been observed that sera furnished by buffaloes, injected into plains or hill bovines produce urticarial or other forms of eruptions in the injected animals.

(vi) Buffaloes are the most economical animals to utilize as serum producers as one of 1,000 lbs. body weight or over can be bled to 3,000 c.c. on 14 or 15 occasions, at intervals of a week, before a second injection of virulent blood need be administered. The protective value of the mixed serum being about 65 c.c. for hill cattle per 600 lbs. body weight, or 3·61 c.c. per plains cattle from the Bhabar and Terai.

(vii) The objections to this sized animal are the handling, the number of cattle attendants required to throw or hold it during the injection of a massive dose of virulent blood, and the mishaps to the animal and the cattle attendants duriug the process of throwing, owing to its strength and great body weight.

(iv) *Does any ratio exist between the protective value of a serum and its specific gravity and the total proteids that it contains?*—The specific gravity of a serum as well as the percentage of total proteids rise after an injection of virulent blood and fall considerably after a number of bleedings, and this occurs after each successive large dose of virulent blood injected.

It would appear that the active principle or principles present in a serum, which bring about the protective changes, do not appear to influence the specific gravity or the percentage of total proteids when they increase or diminish in quantity.

Section IX.—RINDERPEST IN CAMELS.

It has been found as a result of experimental investigations conducted by me that camels in these provinces (U.P.) are susceptible to inoculated bovine rinderpest and *vice versa.*

Camels inoculated with virulent hill bovine blood.—Incubation period varies from 5 to 7 days. In animals which were inoculated about mid-day and whose temperatures were taken twice daily at 9 A.M. and 4 P.M., the primary rise was found as a rule to take place at the 9th or between the 9th and 13th temperatures. The larger the quantity of virulent blood injected, the shorter the period of incubation.

Virulent blood from camels.—Camels injected with virulent blood from animals of the same species, the subjects of rinderpest, exhibited a milder form of the disease, than when primarily inoculated with virulent bovine material.

Result.—The course of the disease always terminated in recovery, whichever source of rinderpest material (bovine or camel) was utilized for the purposes of inoculation.

Symptoms.—Large vesicles which later formed ulcers on the buccal m. m. were observed in 5 cases out of 6. The temperature rose to 39·7 or 40·6° C. and in some cases to a higher degree later. *Diarrhœa,* with the presence of blood, was noted only in one case, although a second animal exhibited a semi-watery condition of the fæces. *Anorexia* was observed, but as a rule the animals fed fairly or well and continued to ruminate during the whole course of the disease. The urine of certain animals contained a saffron coloured pigment which stained the parts it came in contact with. But little can be diagnosed by a casual observer as to the real condition of the animals or even with regard to the fact that they were the subjects of a serious epizootic malady. The gravity of the symptoms in the different animals was not always proportionate to the quantity of blood inoculated.

Course of the disease.—The course of rinderpest in camels occupied a period of 15 to 18 days when uncomplicated by boils or cutaneous eruptions implicating the perineum and posterior extremities.

Hill bulls inoculated with camel blood.—Hill bulls injected with 1 to 10 c.c. of camel blood, drawn respectively on the 5th or 6th days of the disease, contracted a virulent form of rinderpest, indistinguishable as to symptoms, course and pathological changes, from that contracted after inoculation from a bovine source.

Camels hyper-immunized with virulent bovine hill blood.—Serum injected into the hill breed of cattle, 300 c.c. per 600 lbs. body weight, appeared to be toxic in its effects, for it brought about a rise of temperature in the inoculated animals, and later, marked changes in the blood, poikilocytosis, anisocytosis, leucocytosis, reduction in hæmoglobin, etc., followed by death in one instance.

Section X.—GENERAL REMARKS.

In this country the individual members of a large herd of plains cattle of the *same breed* exhibit varying degrees of susceptibility (to rinderpest) from complete protection to total absence of the same. Consequently, in an affected herd, the different animals comprising it will fall within the following categories and be treated according to the methods prescribed respectively :—

I. Cattle showing symptoms of rinderpest:

(*a*) Some in the febrile stage ;
(*b*) Others in the diarrhœa stage.

If animals showing rise of temperature and buccal symptoms, etc., have to be treated by the serum alone method, the dose should be twice that specified per 600 lbs. (body weight) irrespective of weight and if the diarrhœa stage has set in and highly susceptible cattle like the hill breed are attacked, no amount of serum will save them from death.

On the other hand, the majority of the plains animals possess varying degrees of immunity against rinderpest, either hereditary or acquired, therefore even in advanced cases of the disease when diarrhœa is present, some lives may be saved by injecting subcutaneously, better intravenously, large doses of serum irrespective of body weight, say 4 or 5 times the standard dose laid down for each breed of cattle.

II. Cattle which exhibit no symptoms.

This class will comprise two sets of animals:

(*a*) Showing no symptoms, but in whose systems the "contagium" is present and which are passing through the period of incubation ;
(*b*) Animals which may be protected, but which at any rate have not contracted the disease thus far.

In the treatment of the second class of plains bovines two methods are open to us :—

(i) To inject subcutaneously the specified dose per 600 lbs. body weight of any particular serum and then allow the disease which should prove of a modified character to take its course in the affected animals ;

(ii) To inject a large dose of serum subcutaneously, which will confer immunity for varying periods according to the quantity injected. The latter method as requiring no estimate of weight or other calculations is the easiest, and further, the operation takes less time to perform in the field and is therefore to be recommended.

Before concluding this report, it would be of interest to note that during the period of 1900-01 to 1904-05, 2,547,306 c.c. or 468,853 doses of anti-rinderpest serum have been prepared. The mortality in the cattle injected by the serum alone method during the same period being only 0·43 per cent.

It may, perhaps, prove useful to those interested, to have placed before them the most suitable method of gauging the susceptibility of any breed of bovines and buffaloes to rinderpest. The following procedure has been gradually evolved and perfected at Muktesar during the past 5 years and is now adopted as the best means at our disposal for such purposes.

Rough plan to be followed when it is deemed desirable to determine by experimental means the susceptibility of any particular breed of cattle to rinderpest.

(1) In order to roughly determine the susceptibility of different breeds to rinderpest, the experiments should be carried out by the simultaneous method.

(2) The method of approximately determining the dose of anti-rinderpest serum necessary in any given breed of cattle should be as follows :—

Given.—Anti-rinderpest serum standardized by the simultaneous method at 10 c.c. for the *plains* cattle of the United Provinces (India) and 180 c.c. for the cattle of the *hills,* per 600 lbs. body weight ; and that 22 animals of any breed are available for the purposes of experimentation.

I. First test 6 animals of each breed, by the "simultaneous method," and inoculate two with 1 c.c. virulent blood as controls.

2 animals with 25 c.c. serum
2 „ „ 90 c.c. „ } per 600 lbs. body weight.
2 „ „ 180 c.c. „

If all are protected by the doses of serum above mentioned, a less dose than 25 c.c. will be necessary, and the subsequent working will be as below:—

(As out of the given number of 22 animals 6 have already been utilized as above, with 2 animals as controls, of the remaining 14 animals 2 should be utilized as controls for the subsequent test experiments, and 12 tested with the following doses:—

2 animals with 5 c.c.
2 „ „ 8 c.c.
2 „ „ 11 c.c.
2 „ „ 14 c.c. } per 600 lbs. body weight.
2 „ „ 17 c.c.
2 „ „ 20 c.c.

II. If the animals inoculated with 25 c.c. serum succumb to rinderpest and those inoculated with 90 c.c. and 180 c.c. remain alive, then the remaining 12 animals should be tested with the following doses:—

2 animals with 30 c.c.
2 „ „ 40 c.c.
2 „ „ 50 c.c.
2 „ „ 60 c c. } per 600 lbs. body weight.
2 „ „ 70 c.c.
2 „ „ 80 c.c.

III. If the cattle inoculated with 25 and 90 c.c. per 600 lbs. body weight succumb to rinderpest, then the remaining 12 animals should be tested with the doses as mentioned below:—

2 animals with 100 c.c.
2 „ „ 115 c.c.
2 „ „ 130 c.c.
2 „ „ 145 c.c. } per 600 lbs. body weight.
2 „ „ 160 c.c.
2 „ „ 175 c.c.

(3) It will be observed that the doses utilized in each of the three series increase by 3, 10 and 15 c.c. respectively. When a result has been arrived at by the above-mentioned method, further tests should be conducted, if animals be forthcoming, between the doses already experimented with in each series, with a view to determine the exact dose necessary to bring about protection in each breed. Thus, if the animals tested with 5 c.c. succumb to rinderpest and 8 c.c. survive, then test two animals with 6 and 7 c.c. respectively, and similarly in series II and III.

(4) All animals utilized for such experiments as suggested above should be weighed and measured. The measurements should be carried out on several occasions and the mean taken, before comparison is made with the scale weight. All these experiments should be conducted upon animals which have been weighed and measured, in order that if the scale, or actual weight and that by measurement or computed weight do not sufficiently correspond, a certain allowance may be made in favour of animals in poor condition. If no weighing machine can be utilized, the most careful measurements will have to be carried out to serve as a basis in the determination of the doses of serum necessary to be administered by the "simultaneous method" on account of there being no actual weights available for comparison.

(5) The following method of ascertaining the approximate body-weight of bovines will serve all practical purposes in field inoculations:—

Let G represent the girth in inches round the chest behind the shoulder blade.
L represent the length taken in inches from the point of the shoulder to buttock over ribs and under hip joint.
W represent weight in pounds.

Then $G^2 \times L \div 300 = W$.

It is all important when measuring cattle, that the animal should stand in a natural position, but the front feet should be kept close together and similarly the hind feet during the time occupied in taking the measurements of each individual animal.

APPENDICES.

PLAINS BULLS.

Protective values of the sera of plains animals after injection under various conditions with normal and virulent rinderpest blood.

Bull No. 1278 (plains). Age 3 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
						Amount.	Per cent.	Quantity.	Per cent.			Plains Breed.		Hill Breed.		
												Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
24th March 1902 . .	326	...	1	Inoculated 1 c.c. V. B. (1329) Reaction 41·7°C. ; *good*, lasting 6 days.												
21st April " . .	309	1	29	2000	1745	255	12·7	1005	50·25	1028·00	10·2160	...	...	580	1672 1733	
Bull No. 406 (plains). Age 2 years.																
5th September 1900 . .	404	...	1	Inoculated 1 c.c. V. B. (469) Reaction 40·3°C. ; *fair*, lasting 5 days.												
19th " " . .	392	1	13	2200	1950	250	11·3	420	19·09	1025·75	...	...	...	700	...	
Bull No. 411 (plains). Age 3 years.																
4th August 1900 . . .	352	...	1	Inoculated 2·92 c.c. Serum VIII + 1 c.c. V. B. (438). Reaction 40·5°C.; *fair*, lasting 5 days.												
30th " " . .	363	1	27	2200	1950	250	11·3	780	35·45	1029·25	...	...	...	250	1159	

Bull No. 347 (plains). Age 3 years.

15th May 1900 . . .	425	...	1	Inoculated 3·54 c.c. Serum VII + 1 c.c. V. B. (554). Reaction 41·1°C. ; *good*, lasting 5 days.											
3rd June " . . .	...	1	20	2500	2250	250	10·0	1090	43·60	1028·75	...	...	...	250	1180

Bull No. 2147 (plains). Age 3 years.

20th April 1903 . . .	517	1	...	2200	...	...	...	860	39·09	...	...	...	...	...	...
" " " . . .	...	...	...	Injected 6000 c.c. normal defibrinated blood $\left\{\frac{2900}{2094}+\frac{3100}{2098}\right\}$; maximum temperature 41·2°C.											
19th May " . . .	502	2	29	3000	2500	350	11·7	1540	51·33	1027·75	...	...	...	1500	death.
17th June " . . .	307	3	58	3000	2500	defibrinated blood injected into No. 2210.									
1st July " . . .	324	...	72	Inoculated 1 c.c. virulent rinderpest blood (No. 2247).											
5th " " . . .	...	...	...	Discontinued.											

Healthy animal bled 21 times for the sake of comparison.

Bull No. 1274 (plains).

27th May 1902 . . .	...	1	1	1000	875	125	12·5	495	49·50	1024·50	8·3880	...	...	...	...
12th June " . . .	331	2	17	2200	1990	210	9·5	1135	51·59	1023·25	7·1120	...	...	...	...
19th " " . . .	335	3	24	2200	1890	310	14·0	1233	56·04	1022·25	7·6540	...	...	...	...
3rd July " . . .	347	4	38	2200	2000	200	9·0	1205	54·77	1023·50	7·9480	...	...	...	...
10th " " . . .	354	5	45	2500	2195	305	12·2	1250	50·00	1024·50	8·4120	...	...	...	...
16th " " . . .	374	6	51	2500	2140	360	14·4	1270	50·80	1023·50	7·6960	...	...	...	...
18th " " . . .	376	7	53	1000	935	65	8·5	610	61·00	1023·50	7·8080	...	...	...	...
23rd " " . . .	381 376	8	58	1000	840	160	16·0	445	44·50	1023·25	7·9080	...	...	...	...

Healthy animal bled 21 times for the sake of comparison—concluded.

Bull No. 1274 (plains)—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
						Amount.	Per cent.	Quantity.	Per cent.			Plains Breed. Dose.	Plains Breed. No. of animal.	Hill Breed. Dose.	Hill Breed. No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c c.			c.c.		c.c.		
14th August 1902 . .	382 392	9	80	2200	2000	200	9·0	1125	51·14	1025·00	8·6440	...	...	...	...	
21st „ „ . .	397	10	87	2200	1920	280	12·7	1165	52.95	1024·75	8·5080	...	...	...	...	
28th „ „ . .	398	11	94	2200	1790	410	18·6	1035	47·04	1025·50	8·6000	...	...	...	...	
4th September „ . .	420 438	12	102	2200	1800	400	18·1	1030	46·81	1025·00	8·0440	...	...	...	...	
17th „ „ . .	435 427	13	114	2200	1935	265	12·0	975	44·31	1026·50	8·8400	...	...	...	...	
24th „ „ . .	412 414	14	121	2200	1915	285	12·9	970	44·09	1026·75	8·8460	...	...	...	...	
2nd October „ . .	...	15	12	2200	1860	340	15·4	885	40·22	1026·25	8·0480	...	...	...	...	
8th „ „ . .	448 436	16	135	2200	1975	225	10·2	1110	50·45	1025·75	8·5040	...	...	...	...	
15th „ „ . .	444	17	142	2200	1815	385	17·5	965	43·86	1025·75	7·4080	...	...	...	...	
23rd „ „ . .	457	18	150	2200	1990	210	9·6	1065	48·40	1028·00	8·7600	...	...	...	...	
23rd April 1903 . .	488	19	332	2200	1805	395	17·9	780	35·45	1024·75	8·1560	...	...	...	...	
9th May „ . .	513	20	348	3200	1935	265	12·0	905	41·13	1025·50	9·0800	...	...	...	...	
5th June „ . .	542	21	375	2200	2020	180	8·1	700	31·81	1026·00	8·9540	...	...	...	...	
Total .	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Serum alone, tested with virulent blood, injected with one massive dose V. B.

Bull No. 261 (plains). Age 3 years.

16th February 1800 . .	318	...	1	Inoculated 26·5 c.c. Serum I. Reaction 39·4° C.; *nil.*												
1st June „ . .	412	...	108	Inoculated 1 c.c. V. B. (368) Reaction 41·0° C.; *good,* lasting 9 days.												
22nd „ „ . .	...	...	127	Injected 4400 c.c. V. B. (395—plains). Reaction 40·5° C.; *fair,* lasting 6 days.												
12th July „ . .	420	1	147	2300	2030	270	11·7	1000	43·47	1027·50	...	14	...	250	{460 472	The serum from the first three bleedings was collected, mixed and afterwards tested.
19th „ „ . .	455	2	154	2400	2100	300	12·5	1195	49·79	1025·50						
26th „ „ . .	452	3	161	2300	2100	200	8·7	1100	47·82	1023·50						
4th December „ . .	481	4	292	2000	1890	110	5·5	830	41·50	1025·75				1500	{1431 1481	
			Discontinued.													
TOTAL . .	...	...	...	9000	8120	880	9·7	4125	45·83	{1027·5 1023·5	Max. Min.	...	...	...	...	

Inoculation with virulent blood followed by one massive injection.

Bull No. 932 (plains). Age 1½ years.

4th November 1901 . .	318	...	...	Inoculated 1 c.c. V. B. (987; 24 hrs. old). Reaction 41·60 C.; *good,* lasting 8 days.											
17th December „ . .	...	...	34	Injected 6000 c.c. V. B. $\left\{\frac{2175}{1025}+\frac{1510}{1023}+\frac{1945}{1021}+\frac{370}{1020}\right\}$											
6th January 1902 . .	310	1	54	2000	1725	275	13·7	1055	52·75	1031·50	12·4680	...	...	175	1356 1441
13th „ „ . .	317	2	61	2000	1820	180	9·0	1135	56·75	1026·00	9·4540	...	...	...	...
21st „ „ . .	308	3	69	4908	4350	558	11·3	2805	57·15	1024·50	7·9580	...	...	...	...
			Death												
TOTAL .	...	...	...	8908	7895	1013	11·3	4995	56·07	{1031·50 1024·50	Max. Min.	...	...	...	...

Inoculation with virulent blood followed by one massive injection—concluded.

Bull No. 1281 (plains). Age 3 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
5th March 1902 . .	301	...	1	Inoculated 1 c.c. V. B. (1259). Reaction 40·5° C.; *fair*, lasting 5 days.												
24th ,, ,, . .	...	...	20	Injected 6350 c.c. V. B. $\left\{\frac{1650}{1327}+\frac{2200}{1328}+\frac{2500}{1329}\right\}$. Reaction 41° C.; *good*, lasting 10 days.												
17th April ,, . .	296	1	44	1500	1340	160	10·6	605	40·33	1030·75	10·9760	...	...	180	1356 1441	
25th ,, ,, . .	300	2	52	4375	3905	470	10·7	2315	52·91	1029·75	10·5120	...	...	...	...	
25th ,, ,, . .	...	...	Death	...	...	...	...	...	...	...	...	...	...	...	...	
Total .	...	...	...	5875	5245	630	10·7	2920	49·70	1030·75 1029·75	Max. Min.	...	...	...	...	

Simultaneous method followed by one massive injection.

Bull No. 927 (plains). Age 16 months.

4th November 1901 . .	321 S. 357 M. 339 E.	...	...	Inoculated 56·5 c.c. serum of No. 406 + 1 c.c. V. B. (953). Reaction 40·2C.; *fair*, lasting 1 day.
14th ,, ,, . .	...	...	11	Injected 5350 c.c. V. B. $\left\{\frac{1650}{970}+\frac{1500}{967}+\frac{2000}{969}\right\}$. Reaction 41·6 C.; *good*, lasting 9 days.

6th December ,, . .	330 313	1	33	2200	2046	165	7·0	866	39·31	1026·25	8·5160	...	...	250	1243 1444
13th ,, ,, . .	318	2	40	2200	2060	150	6·8	865	38·86	1023·25	6·8540	...	...	...	...
20th ,, ,, . .	310	3	47	2000	1890	110	6·6	915	45·75	1026·25	8·8840	...	...	...	...
27th ,, ,, . .	310	4	54	1800 R. J. vein clotted.	1830	170	9·4	886	48·05	1026·00	8·4400	...	...	...	...
3rd January ,, . .	318	5	61	2000	1880	120	6·0	766	37·75	1026·00	7·8720	...	...	...	...
10th ,, 1902 . .	315	6	68	2000	1840	160	8·0	886	43·25	1025·25	11·7840	...	...	...	...
21st ,, ,, . .	337	...	79	Injected 3900 c. c. V. B. $\left\{\frac{1250}{1128}+\frac{1300}{1129}+\frac{1350}{1130}\right\}$. Reaction 40·8° C.; *good*, lasting 4 days.											
13th February ,, . .	564	7	102	1800	1690	110	6·1	540	30·00	1024·76	8·6780	...	...	...	...
20th ,, ,, . .	327	8	109	1800	1680	120	6·8	570	31·66	1026·50	9·5240	...	...	...	...
27th ,, ,, . .	342	9	116 Death	6160	5736	426	8·9	2600	42·20	1023·76	8·0040	...	...	...	...
TOTAL .	...	...	...	21960	20440	1520	8·9	8830	40·20	1028·25 1023·25	Max. Min.	...	...	...	...

Bull No. 934 (plains). Age 3 years.

19th November 1901 . .	420	...	...	Inoculated 3·5 c.c. serum of 407 (Tesles) + 1 c.c. V. B. (968). Reaction 39·7° C.; *nil.*											
30th ,, ,, . .	...	...	12	Injected 5750 c.c. V. B. $\left\{\frac{3100}{997}+\frac{2860}{998}\right\}$. Reaction 40·6°C.; *good*, lasting 3 days.											
21st December ,, . .	402	1	33	2200	1845	355	16·1	830	37·72	1026·25	8·4520	...	Dose for plains computed at 1/18 of that found necessary for hill animal.	60	1334
28th ,, ,, . .	399	2	40	2200	1880	320	14·6	896	40·68	1027·00	7·8000	...		...	...
4th January 1902 . .	397	3	47	2200	1935	265	12·0	860	39·09	1026·50	8·0160	...		...	...
11th ,, ,, . .	392	4	54	2200	1860	340	15·4	966	43·86	1026·00	8·4320	...		...	...
18th ,, ,, . .	404	5	61	2200	2020	180	8·1	940	42·72	1026·25	8·1500	...		...	...
25th ,, ,, . .	396	6	68	2200	2000	200	9·0	1040	47·27	1024·25	7·8680	...		180	1410 1526

Simul. aneous method followed by one massive injection—continued.

Bull No. 934 (plains). Age 3 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT,				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
30th January 1902	...	...	73	Injected 5000 c.c. V. B. $\left\{\frac{1300}{1150}+\frac{2350}{1154}+\frac{1350}{1157}\right\}$. Reaction 40·3° C.; *fair*, lasting 5 days.												
21st February „	421	7	96	2200	2030	170	7·7	980	44·55	1025·25	8·9640	...	...	70	1406 1538	
28th „ „	423	6	103	2200	2060	140	6·3	1040	47·27	1024·00	8·6500	...	...	...	...	
7th March „	396	9	110 Death	6270	5570	700	11·1	3110	49·60	1023·25	7·2260	...	...	...	...	
TOTAL	...	...	...	23870	21200	2670	11·1	10660	44·65	1027·00 1023·25	Max Min.	...	...	...	...	

Bull No. 286 (plains). Age 3 years.

MONTH AND DATE.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
8th March 1900	383	...	...	Inoculated with 12·7 c.c. (Serum VI) + 1 c.c. V. B. (291). Reaction 41·1° C.; *good*, lasting 5 days.												
8th April „	357	...	52	Injected 6000 c. c. V. B. $\left\{\frac{2700}{326}+\frac{3300}{323,324,326}\right\}$. Reaction 40·1° C.; *fair*, lasting 7 days.												
12th May „	371	1	66	2000	1650	350	17·5	1220	61·00	...	...	1·7	...	30	690	

19th ,,	,,	368	2	73	1800	1530	270	15·0	1050	58·33	...	...	...	...	...	...
26th ,,	,,	373	3	80	2000	1680	310	15·5	1180	59·00	...	...	...	...	...	...
2nd June	,,	384	4	87	2000	1905	95	4·7	1240	62·00	1024·75	...	...	...	...	...
9th ,,	,,	399	5	94	2200	1960	240	10·9	1200	54·59	1025·00	...	...	...	...	...
18th ,,	,,	412	6	101	2200	1940	260	11·8	1205	54·77	1025·00	...	...	...	...	...
30th ,,	,,	429	7	115	2200	2025	175	7·9	1140	51·81	1024·00	...	...	...	...	...
7th July	,,	431	8	122	2200	2015	185	8·4	1360	61·81	1025·25	...	...	...	...	...
14th ,,	,,	391	9	129	2000	1845	155	7·0	1090	54·50	1025·00	...	...	...	...	...
21st ,,	,,	420	10	136	2200	2000	200	9·0	1190	54·09	1023·75	...	...	...	...	...
28th ,,	,,	437	11	143	2300	2151	145	6·3	1240	53·91	1023·00	...	...	...	...	...
4th August	,,	447	12	150	2400	2225	175	7·2	1405	58·54	1023·25	..	5·5	...	100	563
4th September	,,	408	13	181	2000	1850	150	7·5	1050	52·50	1028·00	...	...	...	...	...
4th October	,,	411	14	211	2200	1990	210	9·5	1080	49·09	1025·50	...	...	...	...	...
4th November	,,	428	15	242	2000	1830	170	8·5	850	42·50	1027·00	...	8·9	...	125	691
5th December	,,	418	16	273	2200	2050	150	6·8	840	38·18	1028·50	...	...	...	...	...
4th January	1801	393	17	303	2000	1800	100	5·0	720	36·00	1027·75	...	...	...	...	...
4th February	,,	417	18	334	2000	1840	180	9·0	823	41·15	1025·25	...	9·3	...	150	689
4th March	,,	418	19	362	2000	1850	150	7·5	625	31·25	1025·00	...	...	...	...	...
4th April	,,	428	20	393 418	2000	1885	115	5·7	915	45·75	1024·50	...	9·7	...	175	887
20th ,,	,,	407	...	...	Injected 5600 c.c. V. B. $\left\{\frac{2750}{918}+\frac{2850}{608}\right\}$. Reaction 40·8° C.; *good*, lasting 5 days.											
21st May	,,	461	21	440	2200	2000	200	9·0	1135	51·59	1023·00	...	4·2	...	75	949
28th ,,	,,	453	22	447	2200	2000	200	9·0	1095	49·77	1024·00	...	...	...	...	...
4th June	,,	437	23	454	2000	1956	144	7·2	1100	55·00	1024·00	...	...	...	...	...
11th ,,	,,	463	24	461	2400	2340	60	2·5	1315	54·79	1020·00	...	...	...	...	...
17th ,,	,,	464	25	467	2400	2135	265	11·0	1320	55·00	1022·50	..	...	...	...	...

Simultaneous method followed by one massive injection—continued.

Bull No. 286 (plains). Age 3 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight. Plains breed.		Protective value per 600 lbs. body weight. Hill breed.		Remarks.
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
25th June 1901 . .	lbs. 448	26	475	c.c. 2200	c.c. 1895	Grms. 305	Grms. 13·8	c.c. 1100	c.c. 50·00	1024·00	...	c.c. ...	...	c.c. ...	...	
26th ,, ,, . .	...	...	476	Injected 2650 c.c. V. B. Reaction 40·5° C.; *good*, lasting 5 days.												
12th July ,, . .	474	...	492	Injected 3500 c.c. V. B. $\left\{\frac{2100}{727}+\frac{1400}{728}\right\}$. Reaction 40·6°C.; *good*, lasting 4 days.												
2nd August ,, . .	475	27	513	2300	2030	270	11·7	1155	50·21	1028·00	...	...	...	...	...	Owing to great demand, this serum was tested in bulk.
9th ,, ,, .	475	28	520	2300	2110	190	8·2	1345	58·47	1027·25	...	...	...	...		
16th ,, ,, . .	454	29	527	2200	2030	170	7·7	1225	55·68	1026·00	...	...	...	...	...	
23rd ,, ,, . .	471	30	534	2200	1995	205	9·3	1150	52·27	1026·00	...	...	...	...	...	
30th ,, ,, . .	475	31	541	2200	1995	205	9·3	1230	55·90	1026·00	...	...	...	...	...	
6th September ,, . .	486	32	548	2200	2050	150	6·8	1120	50·90	1023·00	...	...	...	...	...	
9th ,, . .	...	...	...	Injected 3600 c.c. V. B. $\left\{\frac{1616}{818}+\frac{1940}{817}\right\}$. Reaction 40·3° C.; *fair*, lasting 5 days.												
30th October ,, . .	...	Discontinued														
Total .	...	...	...	68700	62571	6129	8·92	35713	51·98	1028 1020	Max. Min.	...	...	...	...	

Bull No. 652 (plains). Age 4½ years. (Duplicate of No. 286.)

21st June 1901	387M. 368S. 378E.	...	...	Inoculated 44·1 c.c. serum (No. IX) + 1 c.c. V. B. (702). Reaction 40·6° C.; *good*, lasting 6 days.											
13th October ,,	353	...	115	Injected 6000 c.c. V. B. $\left\{\begin{matrix}3400-903\\2603-902\end{matrix}\right\}$. Reaction 41·1° C.; *good*, lasting 10 days.											
8th November ,,	376	1	141	2200	2165	35	1·5	1150	52·27	1028·25	9·1140	1·7	...	30	974
15th ,, ,,	380	2	148	2200	2080	140	6·3	1160	52·72	1026·00	7·6920	...	...	...	...
22nd ,, ,,	371	3	155	2200	1995	205	9·3	1200	54·54	1026·50	8·1740	...	...	...	...
29th ,, ,,	363	4	162	2200	1690	310	14·0	1055	47·95	1025·00	7·6820	...	...	...	...
6th December ,,	378	5	169	2200	2080	120	5·4	1085	49·31	1028·00	7·5020	...	...	...	...
13th ,, ,,	363	6	176	2200	1800	400	18·1	1075	48·86	1025·50	7·5040	7·2	...	130	1354
20th ,, ,,	366	7	163	2200	1950	250	11·3	1125	51·13	1026·00	8·3400	...	...	...	...
27th ,, ,,	369	8	190	2200	1970	230	10·4	1085	49·31	1026·50	8·3840	...	...	...	...
3rd January 1902	378	9	197	2200	1935	265	12·0	1025	46·59	1025·25	8·4980	...	...	...	...
10th ,, ,,	390	10	204	2200	1860	340	15·4	890	40·45	1026·25	7·0560	...	...	...	...
17th ,, ,,	400	11	211	2200	1980	220	10·0	1105	50·22	1024·25	8·2280	...	...	...	...
24th ,, ,,	394	12	216	2200	2050	150	6·6	1110	50·45	1025·00	9·3020	11·1	...	200	1339
TOTAL	...	...	...	26400	23735	2665	10·0	13055	49·48	1028·25 1024·25	Max. Min.	...	...	...	...

Bull No. 930 (plains). Age 3 years.

4th November 1901	314S. 316M. 315E.	...	...	Inoculated 13·30 c.c. serum (of 347) + 1 c.c. V. B. (953). Reaction 40·1° C.; *fair*, lasting 6 days.											
25th ,, ,,	309	...	22	Injected 9000 c.c. V. B. $\left\{\frac{2150}{979}+\frac{1250}{950}+\frac{4500}{989}+\frac{1100}{961}\right\}$. Reaction 41·5° C.; *good*, lasting 9 days.											
21st December ,,	334	1	48	2200	1910	290	13·1	855	38·86	1030·25	10·1380	...	...	40	1349 1168

Simultaneous method followed by one massive injection—concluded.

Bull No. 930 (plains). Age 3 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteide in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
28th December 1901 . .	321	2	55	2200	1950	260	11·3	1040	47·27	1029·00	10·6480	...	...	...	...	
4th January 1902 . .	327	3	62	2200	1975	225	10·2	970	44·09	1023·60	9·1560	...	...	...	...	
11th ,, ,, . .	315	4	69	2200	2070	130	5·9	995	45·22	1026·50	7·9240	...	...	...	...	
18th ,, ,, . .	304	5	76	2200	2040	160	7·2	1100	50·00	1025·25	7·9180	...	...	...	...	
26th ,, ,, . .	307	6	83	2200	2060	140	6·3	1135	51·59	1026·00	9·0000	...	...	150 death.	...	
29th ,, ,, . .	...	...	87	Injected 6000 c. c. V. B. $\left\{\frac{1700}{1147}+\frac{2300}{1148}+\frac{2000}{1149}\right\}$. Reaction 40·3° C.; *fair*, lasting 10 days.												
17th February ,, . .	320	7	106	2200	...	...	...	110	...	1026·25	9·4000	...	...	...	...	
25th ,, ,, . .	326	8	114	2200	2080	120	5·4	1060	48·18	1026·00	9·0760	...	...	...	...	
4th March ,, . .	337	9	121	2200	2060	140	6·3	990	45·00	1026·00	10·1520	...	...	...	...	
11th ,, ,, . .	343	10	128	2200	2060	140	6·3	1100	50·00	1025·00	7·8720	...	...	...	...	
18th ,, ,, . .	321	11	135	2200	2070	130	5·9	1040	47·27	1026·00	9·0620	...	...	...	...	
25th ,, ,, . .	315	12	142	2200	2060	140	6·3	1160	52·72	1024·25	7·9200	...	...	...	...	

27th ,,	,, . .	...	...	144	Injected 5600 c.c. V. B. $\left\{\frac{2400}{1330}+\frac{3200}{1333}\right\}$. Reaction 39·6° C.; *nil.*											
18th April	,, . .	318	13	166	2200	1875	325	14·8	1005	45·68	1029·00	10·4000	...	...	...	...
25th ,,	,, . .	323	14	173	2200	1990	210	9·5	1005	45·68	1029·75	10·9240	...	...	...	...
2nd May	,, . .	330	15	180	2200	2010	190	8·6	1090	49·54	1026·50	11·0260	...	...	...	...
9th ,,	,, . .	352	16	187	2200	1995	205	9·3	1085	49·31	1026·60	9·4240	...	...	...	...
16th ,,	,, . .	348	17	194	2200	2025	175	7·9	1015	46·13	1025·00	8·9040	...	...	...	...
23rd ,,	,, . .	331	18	201	2200	2026	175	7·9	1220	55·45	1026·50	9·5040	...	...	...	...
1st June	,, . .	358	...	210	Injected 6000 c.c. V. B. $\left\{\frac{2300}{1490}+\frac{2000}{1515}+\frac{1700}{1514}\right\}$. Reaction 40·4° C.; *fair*, lasting 7 days.											
23rd ,,	,, . .	361	19	232	4000	3505	495	12·3	1755	43·87	1029·50	10·2840	...	...	...	...
27th ,,	,, . .	Discontinued.														
TOTAL .		...	...	...	43600	37760	3640	8·3	19730	45·25	1030·25 1024·25	Max. Min.	... ...	... ...	... ...	... ...

Simultaneous method, interval, V. B., followed by one massive injection.

Bull No. 339 (plains). Age 4 years.

6th May	1900 . .	374	...	...	Inoculated 20 c. c. Dog blood (P. M.)=12 to 13 c.c. serum + 5 c.c. Na cl. Sol. + 2·5 (6°/o) Carbolic Sol. +0·5 c.c. V. B. Reaction 39·8° C.; *nil.*											
6th ,,	1901 . .	428	...	366	Inoculated 1 c.c. H. V. B. (626-24 hrs. old). Reaction 39·5° C.; *nil.*											
7th November	,, . .	466	...	552	Injected 5450 c.c. V. B. $\left\{\frac{2900}{963}+\frac{2550}{028}\right\}$. Reaction 40·4° C.; *fair*, lasting 7 days.											
3rd December	,, . .	467	1	578	2300	2150	160	6·5	860	36·95	1028·00	8·2840	2·5	...	45	1207 1352
10th ,,	,, . .	462	2	585	2300	2165	135	5·8	1135	49·34	1027·00	8·2700	...	...	...	...
17th ,,	. .	437	3	592	2300	1900	400	17·3	1035	45·01	1026·00	8·0540	...	...	...	...

Simultaneous method, interval, V. B., followed by one massive injection—continued.

Bull No. 339 (plains). Age 4 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of aniaml.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
24th December 1901 . .	461	4	599	2300	2030	270	11·7	1165	50·65	1026·25	8·2960	...	...	...	...	
31st ,, ,, . .	441	5	606	2200	1880	320	14·5	966	43·86	1027·25	9·4880	...	...	...	...	
8th January 1902 . .	463	6	614	2200	1680	520	23·6	905	41·13	1025·50	...	...	...	...	...	
16th ,, ,, . .	...	...	621	Injected 5000 c.c. V. B. $\left\{\frac{2600}{1106}+\frac{2500}{1105}\right\}$. Reaction 40·7° C. ; *good,* lasting 8 days.												
6th February ,, . .	486	7	643	2300	2170	130	5·6	1135	49·34	1027·60	9·7200	5	...	90	1342	
13th ,, ,, . .	457	8	650	2300	2160	140	6·0	1100	47·82	1026·25	8·4080	...	...	...	...	
20th ,, ,, . .	485	9 Death	657	6960	6170	790	11·3	3770	54·16	1026·00	8·3540	...	...	...	...	
TOTAL .	...	...	...	25160	22305	2856	11·3	12060	47·93	{ 1028·0 { 1025·0	Max. } Min. }	...	...	...	..	

Bull No. 644 (plains). Age 3¼ years.

22nd May 1901 . .	415 S. 480 M. 422 E.	...	...	Inoculated 5·27 c.c. serum (of Buf. 11) + 1 c.c. V. B. (677) 24 hrs. old. Reaction 40·5° C. ; *nil.*

5th October	,,	442	...	137	Inoculated 10 c.c. V. B. (890) 46 hrs. old. Reaction 39·6° C.; *nil.*											
18th ,,	,,	...	...	150	Injected 5100 c.c. V. B. $\left\{\frac{2500}{912}+\frac{2600}{909}\right\}$. Reaction 40·3° C.; *fair*, lasting 7 days.											
9th November	,,	507	1	172	2300	2135	165	7·1	820	35·65	1026·00	8·9160	...	...	125	1099
16th ,,	,,	472	2	179	2200	2030	170	7·7	945	42·95	1026·00	7·9760	...	...	...	...
23rd ,,	,,	486	3	186	2300	2165	135	5·8	1120	48·69	1025·25	8·2030	...	...	...	...
30th ,,	,,	477	4	193	2300	2105	195	8·4	925	40·21	1026·25	7·8320	...	...	...	...
7th December	,,	461	5	200	2300	2120	180	7·8	1015	44·13	1027·00	7·7540	...	...	...	...
4th ,,	,,	475	6	207	2300	2120	180	7·8	1055	45·87	1026·00	7·9800	...	...	280	1370
17th ,,	,,	...	...	210	Injected 6000 c.c. V. B. $\left\{\frac{1900}{1020}+\frac{2300}{1024}+\frac{1800}{1022}\right\}$. Reaction 41·0°C.; *good*, lasting 6 days.											
6th January	1902	484	7	230	2300	2065	235	10	1165	50·65	1029·50	9·9040	...	...	100	1182
13th ,,	,,	485	8	237	2300	2200	1	4·3	1160	51·30	1026·60	9·4540	...	...	...	...
20th ,,	,,	479	9	244	2300	2180	120	5·2	1270	55·21	1026·00	8·8500	...	...	...	...
27th ,,	,,	482	10	251	2300	2100	200	8·6	1255	54·56	1025·25	9·1180	...	...	...	...
3rd February	,,	493	11	258	2300	2110	160	8·2	1170	50·87	1025·25	8·8560	...	...	...	...
10th ,,	,,	474	12	265	2300	2170	130	5·6	1180	51·30	1025·00	8·8540	...	...	175	1443 1535
12th 14th ,,	,,	...	...	267 269	Injected 5400 c.c. V. B. $\left\{\frac{1700}{1194}+\frac{2100}{1196}+\frac{1600}{1197}\right\}$. Reaction 40·6° C.; *good*, lasting 6 days.											
6th March	,,	485	13	288	2300	2120	180	7·8	1115	48·47	1027·75	10·8460	...	...	225	1602
13th ,,	,,	516	14	296	2300	2165	135	5·8	1160	50·43	1025·75	9·8220	...	...	...	...
20th ,,	,,	513	15	303	2300	2180	120	5·2	1080	46·95	1025·00	8·7480	...	...	...	...
27th ,,	,,	500	16	310	2300	2160	140	6·0	1155	50·21	1024·75	8·4000	...	...	...	...
3rd April	,,	525	17	317	2300	2025	275	11·9	1245	54·13	1025·00	8·6000	...	...	...	...
10th ,,	,,	490	18	324	2300	2150	150	6·5	1175	51·08	1025·75	9·0280	...	...	250	1438
12th ,,	,,	515	...	326	Injected 3300 c.c. V. B. $\left\{\frac{1300}{1362}+\frac{2000}{1361}\right\}$. Reaction 40·6° C.; *good*, lasting 3 days.											

Simultaneous method, interval, V. B., followed by one massive injection—concluded.

Bull No. 644 (plains). Age 3¼ years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentages of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
						Amount.	Per cent.	Quantity.	Per cent.			PLAINS BREED.		HILL BREED.		
												Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.				
3rd May 1902 . .	567	19	347	2300	2150	150	6·5	1020	44·34	1026·75	10·3840	...	...	200	1525	
10th " " . .	578	20	354	2300	2140	160	6·9	1125	49·34	1026·50	11·5720	...	...	...	...	
17th " " . .	671	21	361	2300	2085	215	8·3	1105	48·04	1026·00	9·0168	...	...	...	...	
24th " " . .	575	22	368	2300	2020	280	12·1	1220	53·04	1025·00	9·1680	...	...	450	1812	
27th " " . .	...	...	371	Injected 6000 c.c. V. B. $\left\{\frac{2500}{1480}+\frac{3500}{1488}\right\}$. Reaction 41·2° C.; *good*, lasting 6 days.												
18th June " . .	569	23	393	4000	3355	645	16·1	1555	38·87	1028·75	11·5120	...	...	350	1826	
23rd " " . .	...	...	398	...	...	...	...	...	...	...	...	...	...	...	...	
				Discontinued.												
TOTAL .	...	...	...	54500	50050	4450	8·1	26056	47·80	1029·50 1024·75	Max. Min.	...	...	...	...	

Simultaneous method, interval, V. B., followed by one massive dose.

Bull No. 534 (plains). Age 3 years.

26th November 1900 . .	426	...	1	Inoculated 7·13 c.c. serum (No. VII) + 1 c.c. V. B. (572). Reaction 39·3° C.; *nil.*											
,, ,, 1901 . .	487	...	366	Inoculated 10 c.c. V. B. (981-24 hrs. old). Reaction 40·7° C.; *good,* lasting 1 day.											
18th December ,, . .	...	...	388	Injected 6000 c.c. V. B. $\left\{\frac{2510}{1028}+\frac{2635}{1029}+\frac{855}{1031}\right\}$. Reaction 40·3° C.; *fair,* lasting 7 days.											
7th January 1902 . .	493	1	408	2200	2030	170	7·7	680	30·90	1032·00	10·9640	...	...	40	1170 1238
14th ,, ,, . .	469	2	415	2200	2030	170	7·7	410	18·63	1029·25	11·4080	...	...	...	...
21st ,, ,, . .	441	3	422	2200	1975	225	10·2	825	37·50	1027·50	10·1980	...	...	...	...
28th ,, ,, . .	457	4	429	2400	2250	150	6·2	950	39·58	1026·75	10·1800	...	...	...	...
1st February ,, . .	455	5 Death	433	6240	5750	490	7·8	3085	49·43	1025·50	8·5460	...	...	100	1357
TOTAL .	...	...	...	15240	14035	1205	7 9	5950	39·03	$\left\{\begin{matrix}1032·00\\1025·50\end{matrix}\right.$	Max. Min.	...	...	...	...

Simultaneous method (one massive dose of V. B. and serum on opposite side of the body).

Bull No. 846 (plains). Age 4 years.

4th February 1902 . .	388	...	1	Injected 4000 c.c. V. B. $\left\{\frac{1700}{1173}+\frac{2300}{1172}\right\}$ +20 c.c. serum (No. XIII). Reaction 40·6° C.; *good,* lasting 5 days.											
4th March ,, . .	381	1	29	2200	2025	175	7·9	980	44·54	1028·25	...	...	...	50	2055
11th ,, ,, . .	425	2	36	2200	2040	160	7·2	1100	50·00	1026·00	...	...	...	...	...
18th ,, ,, . .	404	3	43	2200	2050	150	6·8	1190	54·09	1026·00	...	...	...	...	...
25th ,, ,, . .	395	4	50	2200	2060	140	6·3	1115	50·68	1024·25	...	...	...	...	...
1st April ,, . .	406	5	57	2200	2070	130	5·9	1140	51·81	1023·00	...	...	...	...	...
7th ,, , . .	409	6	63	2200	2055	145	6·5	1220	55·45	1024·75	...	...	...	...	...

Simultaneous method (one massive dose of V. B. and serum on opposite side of the body)— continued.

Bull No. 846 (plains). Age 4 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS. BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	6	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
7th April 1902	...	...	...	Injected 6000 c.c. V. B. $\left\{\frac{2200}{1376}+\frac{2000}{1974}+\frac{1800}{1373}\right\}$. Reaction 40·7° C.; *good*, lasting 3 days.												
1st May ,,	437	7	87	2200	2040	160	7·2	1080	49·09	1028·25	...	...	...	30	2166 2058	
8th ,, ,,	428	8	94	2200	1980	220	10·0	1160	52·72	1827·00	...	...	...	...	...	
16th ,, ,,	447	9	101	2200	2050	150	6·8	1055	47·95	1026·25	9·1440	...	...	...	...	
22nd ,, ,,	477	10	108	2200	2060	140	6·3	1195	54·31	1025·25	8·8800	...	...	...	...	
29th ,, ,,	439	11	115	2200	2035	165	7·5	1065	48·40	1025·25	9·0920	...	...	...	...	
5th June ,,	476	12	122	2200	2045	155	7·0	1185	53·86	1025 25	8·4960	...	...	...	...	
8th ,, ,,	502	...	125	Injected 5700 c.c. V. B. $\left\{\frac{3050}{1492}+\frac{2650}{1496}\right\}$. Reaction 40·4° C.; *fair*, lasting 6 days.												
2nd July ,,	477	13	149	2200	2055	145	6·5	945	42·95	1028·75	10·2020	...	...	...	...	
9th ,, ,,	491	14	156	2200	2045	155	7·0	1085	49·31	1026·25	9·2640	...	...	...	...	
16th ,, ,,	527	15	163	2200	2016	185	8·4	1125	51·13	1025·00	9·0760	...	...	...	...	

23rd „ „ . .	517	16	170	2200	1925	275	12·5	835	37·95	1026·50	9·4240	...	...	...	...
31st „ „ . .	507	17	178	2200	1970	230	10·4	1070	48·63	1027·00	8·7880	...	...	...	...
6th August „ . .	508	18	184	2200	1845	355	18·1	950	43·63	1026·50	9·0080	...	...	...	...
9th „ „ . .	524	...	187	Injected 5000 c.c. V. B. $\left\{\frac{2100}{1698}+\frac{1800}{1708}+\frac{1100}{1705}\right\}$. Reaction 40·3° C.; *fair*, lasting 5 days.											
2nd September „ . .	537	19	211	2200	1910	290	13·1	885	40·22	1028·25	11·1240	...	...	...	...
9th „ „ . .	518	20	218	2200	1990	210	9·5	1016	46·13	1027·75	9·4880	...	...	...	...
16th „ „ . .	508	21	225	2200	2010	190	8·6	985	44·77	1027·50	9·7560	...	...	...	...
23rd „ „ . .	531	22	232	2200	2040	160	7·2	1045	47·50	1026·00	9·2880	...	...	...	...
30th „ . . .	518	23	239	2200	2040	160	7·2	1045	47·50	1026·25	8·2240	...	...	...	...
7th October „ . .	601	24	246	2000	2040	150	7·2	945	42·95	1027·50	9·4880	...	...	...	...
13th „ „ . .	506	...	...	Injected 6000 c.c. V. B. $\left\{\frac{1700}{1899}+\frac{2050}{1898}+\frac{2200}{1904}\right\}$. Reaction 40·5° C.; *fair*, lasting 6 days.											
6th November „ . .	...	25	270	5700	5200	500	6·7	1735	30·43	1028·75	...	...	...	...	...
TOTAL .	...	...	...	58500	53595	4905	8·3	27160	46·42	$\left\{\begin{matrix}1028·78\\1023·00\end{matrix}\right.$	Max. Min.	...	...	...	

Bull No. 942 (plains). Age 3 years.

21st February 1902 . .	331	...	1	Injected 5000 c.c. V. B. $\left\{\frac{3000}{1221}+\frac{2000}{1222}\right\}$ +20 c.c. Serum XIII. Reaction 41·2° C.; *good*, lasting 7 days.											
19th March „ . .	337	1	27	2200	1995	205	9·3	1150	52·27	1026·60	9·4020	...	...	135	1905
26th „ „ . .	361	2	34	2200	2010	190	8·6	1210	55·00	1024·25	8·2060	...	...	...	1961
2nd April „ . .	364	3	41	2200	1990	210	9·5	1230	55·90	1024·50	8·9180	...	...	...	...
9th „ „ . .	343	4	48	2200	2085	115	5·2	1115	50·68	1026·00	8·4680	...	...	...	...
16th „ „	377	5	55	2200	1955	245	11·1	1130	51·36	1025·25	8·6640	...	...	...	...

Simultaneous method (one massive dose of V. B. and serum on opposite side of the body)—concluded.

Bull No. 942 (plains). Age 3 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 6·10 LBS. BODY WEIGHT.				REMARKS.
						Amount.	Per cent.	Quantity.	Per cent.			PLAINS BREED.		HILL BREED.		
												Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
23rd April 1902 . .	386	6	62	2200	2065	135	6·1	1175	53·40	1025·25	7·9600	...	...	...	...	
28th „ „ . .	...	...	67	Injected 5800 c.c. V. B. $\left\{\frac{3400}{1398}+\frac{2400}{1399}\right\}$. Reaction 40·4° C. ; *fair*, lasting 5 days.												
22nd May „ . .	407	7	91	2200	1830	370	16·8	1020	46·36	1026·50	8·6800	...	...	90	2185	
29th „ „ . .	422	8	98	2200	2030	170	7·4	1055	47·95	1025·00	8·7020	...	...	...	...	
5th June „ . .	435	9	105	2200	1955	245	11·1	1105	50·22	1024·50	8·3400	...	...	...	...	
12th „ „ . .	446	10	112	2200	1915	285	12·9	1155	52·50	1024·25	8·3440	...	...	...	...	
19th „ „ . .	460	11	119	2200	2005	195	8·8	1155	52·50	1024·25	7·6880	...	...	...	...	
25th „ „ . .	447	12	125	2200	1970	230	10·4	1155	52·50	1025·25	6·2860	...	...	...	...	
10th July „ . .	460	...	140	Injected 6000 c.c. V. B. $\left\{\frac{2000}{1580}+\frac{2050}{1678}+\frac{1950}{1584}\right\}$. Reaction 40·5° C. ; *fair*, lasting 5 days.												
1st August „ . .	468	13	162	2200	2000	200	9·0	795	36·13	1027·50	9·1120	...		140	2110 2177	
8th „ „ . .	467	14	169	2200	1990	210	9·5	895	40·38	1027·00	7·9680	...	...	...	...	

15th ,, ,, . .	450	15	176	2200	1980	220	10·0	885	44·77	1024·25	8·5360	...	...	...	...
22nd ,, ,, . .	471	16	183	2200	2050	150	6·8	1140	51·81	1024·00	8·1600	...	...	...	...
29th ,, ,, . .	489	17	190	2200	1850	350	15·8	1185	53·86	1023·50	7·5680	...	...	...	...
5th September ,, . .	494	18	197	2200	1985	205	8·3	1210	55·00	1024·00	6·4600	...	...	...	...
10th ,, ,, . .	...	...	...	Injected 6500 c.c. V. B. $\left\{\frac{1450}{1839}+\frac{2200}{1835}+\frac{2850}{1842}\right\}$. Reaction 40·5° C.; *fair*, lasting 4 days.											
6th October ,, . .	486	19	228	2200	2055	145	6·5	915	41·59	1027·75	8·7280	...	...	165	2271 2154
14th ,, ,, . .	502	20	238	2200	1940	260	11·8	745	33·86	1028·00	9·0440	...	...	...	
21st ,, ,, . .	520	21	243 Discontinued	5300	4810	490	9·2	2345	44·24	1025·00	8·4040	...	...	...	...
TOTAL .	...	...	...	49300	44475	4825	8·7	23850	48·37	{ 1027·75 { 1024·00	Max. } Min. }	...	...	...	...

Serum alone, interval, V. B., followed by two massive injections.

Bull No. 281 (plains). Age 2 years.

18th February 1900 . .	351	...	1	Inoculated with 87·6 c.c. (Serum 1). Reaction 40·3°C.; *fair*, lasting 2 days.											
1st October ,, . .	488	...	227	Inoculated with 1 c.c. V. B. (488). Reaction 40·7° C.; *good*, lasting 5 days.											
16th ,, ,, . .	441	...	242	Injected 3000 c.c. V. B. (518). Reaction 40·8° C.; *good*, lasting 8 days.											
8th November ,, . .	484	...	285	Injected 9000 c.c. V. B. $\left\{\frac{2700}{556}+\frac{2200}{555}+\frac{4100}{551}\right\}$. Reaction 40·7° C.; *good*, lasting 5 days.											
1st December ,, . .	444	1	287	2000	1850	150	7·5	630	31·50	1032·75	...	...	...	275	1093 1252
8th ,, ,, . .	459	2	294	2200	2020	180	8·1	1020	46·36	1028·75	...	...	...	...	...
15th ,, ,, . .	434	3	301	2000	1850	150	7·5	935	46·75	1028·25	...	...	...	...	...
22nd ,, ,, . .	469	4	308	2200	2030	170	7·7	920	41·81	1028·25	...	...	...	...	...

Serum alone, interval, V. B. followed by two massive injections—concluded.

Bull No. 281 (plains). Age 2 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
29th December 1900	478	5	315	2200	2065	145	6·5	965	43·86	1027·75	...	...	...	...	...	
5th January 1901	443	6	322	2000	1910	90	4·5	830	41·50	1027·25	...	...	...	...	...	
12th " "	476	7	329	2000	1890	110	6·6	760	38·00	1026·50	...	...	...	...	...	
19th " "	479	8	336	2000	1900	100	5·0	855	42·75	1025·50	...	...	...	...	...	
26th " "	476	9	343	2000	1880	120	6·0	805	40·25	1024·75	...	...	...	...	...	
2nd February "	433	10	350	1500	1400	100	6·6	725	48·33	1024·25	...	...	...	...	...	
9th " "	470	11	357	2000	1880	120	6·0	1045	52·25	1024·25	...	...	...	...	...	
16th " "	502	12	364	2000	1850	150	7·5	750	37·50	1026·00	...	...	...	...	...	
23rd " "	506	13	371	2000	1800	200	10·0	790	39·50	1026·75	...	...	...	...	...	
2nd March "	505	14	378	2000	1760	240	12·0	865	43·25	1025·00	...	...	...	...	...	
9th " "	483	15	385	2000	1870	130	6·5	1120	56·00	1022·75	...	...	...	817	1088	
11th May "	493	16	448	2000	1880	120	6·0	660	33·00	1024·00	...	...	...	...	...	
18th " "	494	17	455	2000	1820	180	9·0	775	38·75	1023·25	...	...	...	...	...	

18th June „	496	18	486	2200	2000	200	9·0	800	36·36	1026·25	...	...	...	...	...
18th July „	453	19	516	2200	1980	220	10·0	780	34·45	1026·00	...	...	...	850	1478 1669
17th August „	485	20	546	2200	1945	256	11·6	820	37·27	1026·00	...	...	...	...	...
TOTAL	...	...	...	40700	27570	3130	7·6	16850	41·40	{ 1032·75 { 1023·26	Max. Min.	...	...	...	...

Simultaneous method followed by two massive doses of V. B.

Bull No. 926 (plains). Age 2 years.

	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.		c.c.		c.c.		
4th November 1901	327S. 314M. 327E.	...	...	Inoculated 40·87 c.c. serum of 407 (Normal) + 1 c.c. V. B. (953). Reaction 40°C. ; *poor*, lasting 6 days.											
16th „ „	...	...	13	Injected 1600 c.c. V. B. (966). Reaction 41·5°C. ; *good*, lasting 7 days.											
5th December „	328	...	32	Injected 3400 c.c. V. B. $\left\{\frac{2650}{988}+\frac{750}{1005}\right\}$. Reaction 41·5°C. ; *good*, lastiog 8 days.											
26th „ „	300	1	53	2200	1910	240	10·9	1305	59·31	1028·50	8·4200	...	Dose for plains computed at 1/18 of that found necessary for hill animals.	over 350	...
2nd January 1902	324	2	60	2200	1920	280	12·7	1205	54·77	1022·50	7·3040	...		...	...
9th „ „	326	3	67	2200	1850	350	15·9	1220	55·45	1025·50	8·4400	...		...	...
14th „ „	315	...	72	Injected 3900 c.c. V. B. (1102). Reaction 40·4°C. : *fair*, lasting 4 days.										...	...
7th February „	290	4	98	2000	1850	150	7·5	1120	56·00	1025·00	8·7380	...		...	...
15th „ „	272	5	104	3730	3290	440	11·7	1860	52·54	1023·75	7·9680	...		...	...
15th „ „	259	...	Death												
TOTAL	...	...	...	12330	10820	1460	11·03	6810	55·23	{ 1028·50 { 1022·50	Max. } Min. }	...	...	...	...

Simultaneous method, interval, V. B., followed by two massive doses of V. B., at intervals.

Bull No. 748 (plains). Age over 5 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of to'al proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
10th August 1901	361S. 368M. 365E.	...	1	Inoculated 9·12 c.c. serum (of 407) + 1 c.c. V. B. (782, 48 hrs old). Reaction 39·4°C.; *nil.*												
21st December 1901	390	...	134	Inoculated 10 c.c. V. B. (1038). Reaction 38·5° C.; *nil.*												
4th and 5th January 1902	400	...	149	Injected 4200 c.c. V. B. $\frac{1300}{1071} + \frac{2900}{1072}$ + 1800 c.c. V. B. $\frac{1700}{1073} + \frac{100}{1075}$. Reaction 41°C.; *good*, lasting 6 days.												
27th January 1902	408	1	171	2300	2040	260	11·3	1120	48·69	1028·00	10·1120	...	...	60	1952 1958	
3rd February „	410	2	178	2300	2125	175	7·6	1020	44·34	1026·00	8·8180	...	...	...	...	
0th „ „	411	3	185	2300	2150	150	8·5	1090	47·39	1024·75	8·9960	...	...	...	...	
17th „ „	427	4	192	2300	2125	175	7·8	1060	46·08	1025·26	8·7200	...	...	...	...	
24th „ „	428		199	2300	2130	170	7·3	1135	49·34	1024·50	8·6000	...	...	...	...	
3rd March „	421		208	2300	2120	180	7·8	1020	44·34	1025·00	8·6560	...	...	...	...	
L „ „	...	...	208	Injected 4000 c.c. V. B. $\left\{\frac{1350}{1260} + \frac{1350}{1281} + \frac{1300}{1259}\right\}$. Reaction 41°C.; *good*, lasting 8 days.												

26th „	„	424	7	229	2300	2130	170	7·3	1000	43·47	1025·50	9·1180	...	...	21	...
2nd April	„	400	8	238	2300	2150	150	6·5	1100	47·82	1025·00	9·0320	...	...	...	...
9th „	„	399	9	243	2300	2180	120	5·2	1115	48·47	1025·50	7·7500	...	...	...	...
16th „	„	420	10	250	2300	2165	135	5·8	1130	49·13	1025·00	8·7320	...	...	...	...
23rd „	„	426	11	257	2300	1935	365	15·6	1205	52·39	1024·50	7·9600	...	...	...	...
30th „	„	412	12	254	2300	2110	190	8·2	1250	54·34	1023·25	8·4940	...	...	...	...
3rd May	„	...	...	257	Injected 5000 c.c. V. B. $\left\{\frac{2300}{1427}+\frac{2700}{1425}\right\}$. Reaction 40·5°C.; *fair*, lasting 6 days.											
27th „	„	426	13	281	3000	2775	225	7·5	1255	41·83	1027·00	9·4400	...	...	80	1540
3rd June	„	439	14	288	2300	1930	370	16·0	1120	48·69	1025·50	9·0380	...	...	...	...
10th „	„	440	15	295	2300	2120	180	7·8	1235	53·69	1026·00	8·5280	...	...	...	...
12th „	„				Discontinued.											
	Total	...	...	...	35200	32185	3015	8·58	16855	47·88	1028·00 1023·25	Max. Min.	...	...	...	...

Bull No. 331 (plains). Age 4 years.

3rd May 1900		484	...	...	Inoculated 4·03 c.c. Serum (No. VII) + 1 c.c. V. B. (327). Reaction 39·5°C.; *nil.*											
20th April 1901		411	...	353	Inoculated 10 c.c. V. B. (615). Reaction 39·4°C.; *nil.*											
15th May	„	451	...	378	Injected 6700 c.c. V. B. $\left\{\begin{matrix}2195-671\\2070-669\\2435-668\end{matrix}\right\}$. Reaction 40·8°C.; *good*, lasting 8 days.											
3rd June	„	488	...	397	Injected 3300 c.c. V. B. $\left\{\begin{matrix}1925-685\\1375-692\end{matrix}\right\}$. Reaction 41·0°C.; *good*, lasting 3 days.											
28th „	„	474	1	420	2300	2140	180	6·9	890	38·69	1024·25	...				
3rd July	„	468	2	427	2300	2085	215	9·3	1260	54·78	1022·25	...				
10th „	„	466	3	434	2300	2085	235	10·1	1320	57·39	1023·25	...				

Simultaneous method, interval, V. B., followed by two massive doses of V. B. at intervals—concluded.

Bull No. 331 (plains). Age 4 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BRED.		HILL BRED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
17th July 1901	476	4	441	2300	2030	270	11·7	1270	55·21	1023·25	...	...	...	...	...	
24th ,, ,,	470	5	448	2300	2050	250	10·8	1295	56·30	1023·25	...	...	...	...	...	
31st ,, ,,	473	6	455	2300	2065	235	10·2	1235	53·69	1022·00	...	...	...	...	...	
21st September 1901	...	...	507	Death.	...	...	...	...	...	...	...	...	...	...	...	
TOTAL	...	...	...	13800	12435	1365	9·8	7270	52·63	{ 1024·25 { 1022·00	Max. } Min. }	...	...	...	...	

Massive Simultaneous followed by second massive injection.

Bull No. 1271 (plains). Age about 6 years.

5th March 1902	399	...	1	Injected 1000 c.c. V. B. (1259) + 16 c.c. serum (No. XIII). Reaction 40·4°C.; *fair*, lasting 3 days.
18th ,, ,,	...	...	14	Injected 5200 c.c. V. B. $\left\{\frac{1300}{1303}+\frac{1950}{1305}+\frac{1950}{1306}\right\}$. Reaction 40·8°C.; *good*, lasting 7 days.

6th April	,,	424	1	36	2200	2040	160	7·2	1030	48·18	1029·00	9·8160	...	...	135	1902 2065
15th ,,	,,	427	2	42	2200	1790	410	18·6	965	43·86	1026·75	8·8920	...	...	...	...
22nd ,,	,,	423	3	49	2200	2000	200	9·0	1000	45·45	1026·75	9·6280	...	...	...	...
29th ,,	,,	443	4	56	2200	1990	210	9·5	980	44·54	1024·50	9·7360	...	...	...	...
6th May	,,	442	5	63	2200	1950	250	11·3	1076	48·86	1024·75	8·4780	...	...	...	...
13th ,,	,,	466	6	70	2200	1996	205	9·3	1180	53·63	1025·00	8·5080	...	...	...	...
16th ,,	,,	454	...	72	Injectsd 5500 c.c. V. B. $\left\{\frac{2900}{1454}+\frac{2600}{1455}\right\}$. Reaction 41·0°C.; *good*, lasting 7 days.											
6th June	,,	465	7	94	2200	2010	190	8·6	1045	47·50	1027·60	9·8240	...	...	...	...
13th ,,	,,	453	8	101	2200	1965	235	10·6	1005	45·68	1025·25	8·4480	...	...	...	...
20th ,,	,,	443	9	108	2200	1980	220	10·0	1050	47·72	1026·25	9·1240	...	...	...	...
27th ,,	,,	420	10	115	2200	1910	290	13·1	1005	45·68	1026·00	9·3140	...	...	...	...
4th July	,,	417	11	122	2200	2040	160	7·2	1165	52·95	1026·00	8·9780	...	...	...	...
11th ,,	,,	413	12	129	2200	1960	240	10·9	1125	51·13	1024·50	8·0400	...	...	...	...
29th ,,	,,	452	...	147	Injected 4500 c.c. V. B. $\left\{\frac{1200}{1733}+\frac{2200}{1675}+\frac{1100}{1607}\right\}$. Reaction 40·2°C.; *fair*, lasting 6 days.											
16th August	,,	428	13	167	4000	3465	536	13·3	1685	42·12	1027·60	9·9840	...	...	...	...
29th ,,	,,	Disconti	nued.													
	TOTAL	...	...	...	30400	27095	3306	10·8	14340	47·17	1029·00 1024·50	Max. Min.	...	...	...	...

Bull No. 1273 (plains). Age 4 years.

11th March	1902	343	...	1	Injected 3900 c.c. V. B. $\left\{\frac{2000}{1266}+\frac{1900}{1262}\right\}$ +15 c.c. serum (No. XIII). Rsaction 41·4°C.; *good*, lasting 14 days.
1st April	,,	324	...	22	Injected 4500 c.c. V. B $\left\{\frac{1700}{1337}+\frac{160}{134}+\frac{1003}{1314}\right\}$. Esaction 40·6°C.; *good*, lasting 7 days.

Massive Simultaneous followed by second massive injection—continued.

Bull No. 1273 (plains). Age 4 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	1	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c c	c.c.			c.c.		c.c.		
25th April 1902 . .	310	1	46	2200	2020	180	8·1	825	37·50	1027·50	9·65	...	...	180	2000	
2nd May ,, . .	307	2	53	2200	2050	150	6·6	1080	49·09	1025·50	9·4440	...	...	...	...	
9th ,, ,, . .	323	3	60	2200	2045	155	7·0	1125	51·13	1024·50	8·4360	...	...	...	...	
16th ,, ,, . .	330	4	67	2200	2060	140	6·3	1065	48·40	1024·00	8·6440	...	...	...	...	
23rd ,, ,, . .	321	5	74	2200	1965	235	10·6	790	35·90	1024·50	8·4640	...	...	...	...	
30th ,, ,, . .	321	6	81	2200	1985	215	9·7	1090	45·54	1024·25	8·4400	...	...	...	...	
nd June ,, . .	334	...	...	Injected 4700 c.c. V. B. $\left\{\frac{1950}{1489}+\frac{1900}{1491}+\frac{1650}{1514}\right\}$. Reaction 41·3°C.; *good*, lasting 6 days.												
27th ,, ,, . .	327	7	109	2200	2020	180	6·1	725	32·95	1024·75	9·6200	...	...	...	...	
4th July ,, . .	332	8	116	2200	2070	130	5·9	1075	48·36	1024·00	8·4600	...	...	...	...	
11th ,, ,, . .	325	9	125	2200	2025	175	7·9	1000	45·45	1024·75	8.0960	...	...	...	...	
18th ,, ,, . .	326	10	132	2200	1990	210	9·5	1005	45·68	1024·25	7·9360	...	...	...	...	
25th ,, ,, . .	321	11	139	2200	2015	185	8·4	1145	52·04	1023·50	7·6040	...	...	...	...	

1st August ,, . .	328	12	146	2200	1915	285	12·9	1080	49·09	1023·75	7·0840	...	...	...	...
7th ,, ,, . .	328	...	152	Injected 4500 c.c. V. B. $\left\{\frac{1950}{1703}+\frac{2200}{1780}+\frac{350}{1691}\right\}$. Reaction 40·8°C.; *good*, lasting 5 days.											
27th ,, . .	309	13	172	2200	1925	275	12·5	905	41·13	1026·75	9·8560	...	...	...	...
4th September ,, . .	320	14	180	2200	1980	220	10·0	1025	46·59	1024·75	8·8200	...	...	...	...
10th ,, . .	336	15	186	2200	1990	210	9·5	1105	50·22	1023·50	9·0400	...	...	...	...
17th ,, . . .	349	16	193	2200	2010	190	8·6	1105	50·22	1023·50	7·2360	...	...	...	...
24th ,, ,, . .	395	17	200	2200	2025	175	7·9	1235	56·13	1022·25	7·8560	...	...	...	...
1st October ,, . .	349	18	207	2200	2050	150	6·8	1295	58·86	1023·75	8·0920	...	...	...	...
7th ,, ,, . .	371	...		Injected 5200 c c. V. B. $\left\{\frac{2560}{1882}+\frac{2650}{1757}\right\}$. Reaction 41·4°C.; *good*, lasting 6 days.											
26th ,, ,, .	...	19	226	5142	4675	467	9·0	2755	53·57	1029·00	10·4480	...	...	...	...
	Di·cont	inued.													
TOTAL .	...	...	...	44742	40815	3927	8·7	21430	47·89	1029·00 1022·25	Max. Min.	...	...	...	...

Bull No. 1295 (plains). Age over 7 years.

15th March 1902 . . .	4·4	...	1	Injected 4200 c.c. V. B. $\left\{\frac{1500}{1065}+\frac{2700}{1298}\right\}$ +6·45 c.c. $\left\{\begin{matrix}\text{Serum}\\ \text{No. X.}\end{matrix}\right\}$. Reaction 40·7°C.; *good*, lasting 13 days.												
17th ,, ,, . . .	...	...	2	Injected 1700 c.c. V. B. (1307), in all=5900 c. c.												
14th April ,, . . .	466	1	30	2200	1770	430	19·5	965	43·86	1029·50	10·0880	...	...	over 300	...	300 death.
21st ,, ,, . . .	476	2	37	2200	1800	400	18·1	995	45·22	1027·75	9·7360	...	...	...	...	
28th ,, ,, . . .	487	3	44	2200	1935	265	12·0	940	42·72	1025·50	9·9680	...	...	...	...	
5th May ,, . . .	501	4	51	2200	2035	155	7·5	1155	52·50	1027·00	8·5320	...	...	...	...	
12th ,, ,, . . .	511	5	58	2200	1995	205	9·3	1155	52·50	1027·00	9·7920	...	...	...	...	
19th ,, ,, . . .	511	6	65	2200	1945	255	11·5	1095	49·77	1026·25	8·6020	...	...	...	...	

Massive Simultaneous followed by second massive injection—concluded.

Bull No. 1295 (plains). Age over 7 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	6	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
19th May 1902 . . .	...	...	...	Injected 4700 c.c. V. B. $\left\{\frac{2200}{1453}+\frac{2500}{1460}\right\}$. Reaction 40·7°C.; *good*, lasting 6 days.												
14th June " . . .	521	7	90	2200	2060	140	6·3	1055	48·40	1027·50	10·4200	...	...	...	...	
24th " . . .	523	8	97	5000	4410	560	11·2	2315	46·30	1026·50	9·3760	...	...	...	...	
27th " . . .	Discontinued.															
Total .	...	...	...	20400	17980	2420	11·6	9685	47·47	1029·50 1026·25	Max. Min.	...	...	...	...	

HILL BULLS.

Hill animals which have passed through an attack of rinderpest either after inoculation of virulent blood or the Simultaneous method.

Bull No. 358 (hill). Age 6 years.

26th May 1900 . . .	258	...	...	Inoculated 1 c.c. V. B. (358 direct). Reaction 41°C.; *good*, lasting 7 days.												
4th June " . . .	197	1	9	200	1625	375	16·7	680	34·00	1024·25	...	...	...	1150	1096	Death.

Bull No. 1167 (hill).

29th January 1902 . .	210 S. 213 M. 212 E.	...	...	Inoculated 31·8 c.c. serum (of 352) + 0·5 c.c. V. B. (1131). Reaction 40·6°C.; *good,* lasting 5 days.												
10th February „ . .	...	1	13	1000	880	120	12·0	490	49·00	1025·50	...	...	...	200	1682 1615	

Bull No. 1159 (hill). Age 1½ years.

29th January 1902 . .	213 S. 209 M. 213 E.	...	...	Inoculated 88·75 c.c. serum (of 411) +0·5 c.c. V. B. (1131). Reaction 41·2°C.; *good,* lasting 6 days.												
17th February „ . .	...	1	20	1000	900	100	10·0	520	52·00	1021·50	...	...	...	100	1237 1533	

Bull No. 1339 (hill). Age 4 years.

27th March 1902 . .	163 S. 163 M. 163 E.	...	...	Inoculated 54·33 c.c. serum (of 652) + 0·5 c.c. V. B: (1333). Reaction 40·4°C.; *fair,* lasting 7 days.												
21st April „ . .	...	1	26	2150	1925	225	10·4	1455	67·67	1023·00	7·2800	...	...	120	1475 1534	

Bull No. 1334 (hill). Age 3 years

27th March 1902 . .	198 S. 201 M. 200 E.	...	...	Inoculated 20 c.c. serum (of 934) +0·5 c.c. V. B. (1333). Reaction 40·4°C.; *fair,* lasting 5 days.												
21st April „ . .	...	1	26	2955	2650	305	10·3	1525	51·60	1024·50	8·3560	...	...	110	1497	

Bull No. 794 (hill). Age 1 year.

10th August 1901 . .	153 S. 158 M. 155 E.	...	...	Inoculated 38·70 c.c. serum (of 281) +0·5 c.c. V. B. (782, 48 hrs. old). Reaction 41·7°C.; *good,* lasting 5 days.

Hill animals which have passed through an attack of rinderpest either after inoculation of virulent blood or the Simultaneous method—concluded.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine. Amount.	Fibrine. Per cent.	Serum. Quantity.	Serum. Per cent.	Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight. Plains Breed. Dose.	Plains Breed. No. of animal.	Hill Breed. Dose.	Hill Breed. No. of animal.	Remarks.
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
Bull No. 794 (hill). Age 1 year.																
6th September 1901 . .	...	1	28	2896	2695	263	9·0	1710	59·00	1023·00	...	25	929	40	1210 1301	
Bull No. 1342 (hill). Age 3 years.																
27th March 1902 . .	157 S. 146 M. 156 E.	...	...	Inoculated 23·55 c.c. serum (of 339) +0·5 c.c. V. B. (1333). Reaction 41·1°C.; *good*, lasting 7 days.												
28th April ,, . .	...	1	33	2320	2080	240	10·3	1520	65·51	1022·00	7·2800	...	...	100	1470	
Bull No. 1354 (hill). Age 2 years.																
27th March 1902 . .	168 S. 149 M. 168 E.	...	...	Inoculated 36·4 c.c. serum (of 652) +0·5 c.c. V. B. (1333). Reaction 40·5°C.; *fair*, lasting 6 days.												
26th April ,, . .	...	1	33	2130	1910	220	10·3	1410	66·19	1021·25	6·8800	...	...	90	1474	

Bull No. 1168 (hill). Age 8 years.

29th January 1902 . .	229 S. 224 M. 2.6 E	...	...	Inoculated 19 c.c. serum (of 930) + 0·5 c.c. V. B. (1131). Reaction 41·1°C.; *good*, lasting 6 days.											
6th March ,, . .	251	1	32	1400	1200	200	14·2	650	46·42	1026·50	...	...	...	90	1320

Hill animals which have been inoculated by the Simultaneous method, and after an interval with varying amounts of virulent rinderpest blood.

Bull No. 1113 (hill). Age 4 years.

15th January 1902 . .	183 S. 186 M. 165 E.	...	1	Inoculated 30·83 c.c. serum (of 77) +0·5 c.c. V. B. (1105, 24 hrs. old). Reaction 40·2°C.; *fair*, lasting 5 days.											
1st February ,, . .	180	...	18	Injected 500 c.c. V. B. (1152). Reaction 40·5°C.; *fair*, lasting 4 days.											
22nd ,, ,, . .	200	1	39	2980	2675	305	10·2	1600	53·69	1025·25	...	...	...	120	{ 1257 { 1531

Bull No. 1114 (hill). Age 4½ years.

15th January 1902 . .	156 S. 167 M. 163 E.	...	1	Inoculated 81·5 c.c. serum (of 352) +0·5 c.c. V. B. (1105). Reaction 41·2°C.; *good*, lasting 7 days.											
30th ,, ,, . .	181	...	16	Injected 1000 c.c. V. B. (1150). Reaction 41·2°C.; *good*, lasting 5 days.											
20th February ,, . .	179	1	37	3170	2850	320	10·0	1505	47·47	1025·50	...	...	...	90	1246

Bull No. 1112 (hill). Age 3 years.

15th January 1902 . .	194 S. 193 M. 194 E.	...	1	Inoculated 66·46 c.c. serum (of 451) +0·5 c.c. V. B. (1105, 24 hrs. old). Reaction 40·2°C.; *fair*, lasting 2 days.											
1st February ,, . .	191	...	16	Injected 2000 c.c. V. B. $\left\{\frac{450}{1152}+\frac{1150}{1151}\right\}$. Reaction 40·6°C.; *good*, lasting 9 days.											
22nd ,, ,, . .	197	1	39	2260	2025	235	10·3	1640	72·56	1019·50	...	...	...	700	1770

Simultaneous method followed at intervals by gradually increasing doses of V. B.

Bull No. 77 (hill). Age 6 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
6th May 1899	247	...	1	Inoculated 19 c.c. Serum (1) + 0·6 c.c. V. B. Reaction 40·2°C.: *fair*, lasting 2 days.												
14th June ,,	256	...	40	Inoculated 10 c.c. V. B. (82). Reaction 39·4°C.; *nil*.												
25th April 1900	293	...	81	Injected 100 c.c. V. B (324). Reaction 39·5°C.; *nil*.												
3rd May ,,	...	...	89	Do. 250 c.c. V. B. (327). Reaction 39·5°C.; *nil*.												
16th ,, ,,	...	...	102	Do. 500 c.c. V. B. (354). Reaction 39·7°C.; *nil*.												
27th ,, ,,	310	...	113	Do. 1000 c.c. V. B. (362). Reaction 40·1°C.; *fair*, lasting 1 day.												
18th June ,,	341	1	135	1300	1300	...	...	660	50·76	1026·50	...	8·8	...	120	487	
25th ,, ,,	...	...	142	Injected 1500 c.c. V. B. (390). Reaction 40·2°C.; *fair*, lasting 5 days.												
14th July ,,	335	2	161	1300	1140	160	12·3	660	50·76	1027·50	...	3·3	...	75	508 757	
21st ,, ,,	335	3	168	1300	1150	150	11·5	850	50·00	1026·50	...	...	...	...	...	
28th ,, ,,	351	4	175	1400	1275	125	8·9	770	55·00	1025·00	...	...	...	...	...	
30th ,, ,,	...	...	177	Injected 2000 c.c. V. B. (436). Reaction 40·2°C.; *fair*, lasting 6 days.												
20th August ,,	364	5	198	1400	1200	200	14·2	650	46·42	1029·25	...	1·9	...	35	568	

27th ,,	,,	353	6	205	1200	1080	120	10·0	620	51·66	1028·50	...	...	...	...	...
3rd September	,,	353	7	212	1200	1120	80	6·6	595	49·58	1028·75	...	...	...	...	...
11th ,,	,,	...	...	220	Injected 3000 c.c. V. B. $\left\{\frac{2850}{496}+\frac{150}{496}\right\}$. Reaction 40·4°C.; *fair*, lasting 6 days.											
1st October	,,	361	8	240	1300	1190	110	8·4	590	45·38	1027·75	...	1·7	...	30	706
8th ,,	,,	389	9	247	1400	1305	95	6·7	735	52 50	1027·00	...	...	...	...	.
16th ,,	,,	391	10	254	1300	1200	100	7·7	600	46·15	1028·25	...	...	...	...	...
2nd November	,,	...	...	272	Injected 4000 c.c. V. B. $\left\{\frac{2600}{552}+\frac{1400}{551}\right\}$. Reaction 40·4°C.; *fair*, lasting 7 days.											
23rd ,,	,,	384	11	293	1300	1200	100	7·7	635	48·84	1030 00	...	1·9	...	35	775
30th ,,	,,	395	12	300	1350	1285	65	4 8	675	50·00	1029·00	...	...	...	...	...
7th December	,,	402	13	307	1500	1400	100	6·8	840	56·00	1027·25	...	...	...	...	...
20th April	1901	418	...	441	Injected 5000 c c. V. B. $\left\{\frac{3850}{611}+\frac{1150}{614}\right\}$. Reaction 40·8° C.; *good*, lasting 6 days.											
10th May	,,	407	14	461	1250	1100	150	12·0	655	52·40	1027·75	...	3·9	...	70	1313
17th ,,	,,	412	16	468	1500	1375	125	8·3	800	53·33	1227·50	...	...	...	...	...
24th ,,	,,	419	18	476	1500	1380	120	8·0	790	52·66	1025·25	...	...	...	...	...
27th ,,	,,	407	...	478	Injected 6000 c. c. V. B. $\left\{\frac{2100}{681}+\frac{1750}{682}+\frac{2150}{883}\right\}$. Reaction 41·1°C.; *good*, lasting 6 days.											
17th June	,,	391	17	499	1200	1035	165	13·7	600	50·00	1029·00	...	5·5	...	100	1115
24th ,,	,	392	18	506	1400	1225	175	12·5	750	53·57	1027·00	...	...	...	...	...
1st July	,,	418	19	513	1500	1355	145	9·6	800	53·33	1026·00	...	...	...	...	...
1st ,,	,,	...	...	...	Injected 7000 c.c. V. B. $\left\{\frac{4150}{730}+\frac{1600}{722}+\frac{1250}{720}\right\}$											
3rd ,,	,,	407	Died during night.													
	TOTAL	...	...	...	25510	23315	2285	8·9	13075	51·25	1030 Max. 1025 Min.					

Simultaneous method followed at intervals by gradually increasing doses of V. B. —concluded.

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13.	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
Bull No. 460 (hill). Age 5 years.																
27th August 1900 . .	323	...	1	Inoculated, 166·5 c.c. serum (261) +0·5 c.c. V. B. Reaction 39·6°C.; *nil.*												
11th September " .	345	...	16	Injected 10 c.c. V. B. (495). Reaction 39·8°C.; *nil.*												
23rd " " . .	...	...	28	Do. 1000 c.c. V. B. (501). Reaction 40·9°C.; *good*, lasting 7 days.												
11th October " . .	386	...	46	Do. 3500 c.c. V. B. (505). Reaction 40·7°C.; *good*, lasting 6 days.												
3rd November " . .	389	...	69	Do. 6000 c.c. V. B. $\left\{\frac{3200}{554}+\frac{2800}{555}\right\}$. Reaction 41°C.; *good*, lasting 8 days.												
30th " " . .	399	1	96	1350	1290	60	4·4	325	24·07	1030·25	..	...	...	45	770	
3rd May 1901 . .	457	2	251	1500	1385	115	7·6	515	34·33	1025·00	...	...	...	435	1156	
4th " " . .	...	...	252	Injected 6100 c.c. V. B. $\left\{\frac{3080}{1626}+\frac{3020}{627}\right\}$. Reaction 41·8°C.; *good*, lasting 6 days.												
26th " " . .	452	3	276	1400	1270	130	9·2	510	36·42	1026·00	...	...	...	42	1203 1418	
4th June " . .	447	4	283	1400	1280	120	8·5	533	38·07	1025·00	...	...	...	...		

11th ,,	,,	460	5	290	1400	1265	136	9·6	507	36·21	1023·50	...	...	...	...	...
16th ,,	,,	459	6	297	2000	1855	146	7·2	780	38·00	1026·00	...	...	...	250	1484
20th June	1901	...	...	299	Injected 7825 c.c. V. B. $\left\{\frac{2025}{702}+\frac{1700}{703}+\frac{1850}{709}+\frac{2250}{710}\right\}$. Reaction 41·3°C.; *good*, lasting 5 days.											
16th July	,,	456	7	325	2200	1965	235	10·6	1056	48·09	1027·00	...	..	...	115	1057 1366
23rd ,,	,,	451	8	332	2200	2030	170	7·7	985	44·77	1026·50	...	...	...	...	...
30th ,,	,,	439	9	339	2000	1925	75	3·7	1035	51·75	1025·75	...	...	...	...	...
6th August	,,	442	10	346	2000	1825	175	8·7	1036	54·25	1025·75	...	...	...	...	...
13th ,,	,,	438	11	353	2000	1830	170	8·5	1000	50·00	1025·25	...	...	...	...	...
20th ,,	,,	443	12	360	2000	1816	185	9·2	1040	52·00	1025·00	...	...	...	400	1412 1469
23rd ,,	,,	...	...	363	Injected 3900 c.c. V. B. $\left\{\frac{1900}{797}+\frac{2000}{798}\right\}$. Reaction 41°C.; *good*, lasting 5 days.											
13th September	,,	478	13	384	2000	1730	270	13·5	940	47·00	1026·00	...	...	...	120	1416
20th ,,	,,	473	14	391	2000	1860	140	7·0	1020	51·00	1025·00	...	...	...	...	...
27th ,,	,,	467	15	398	2000	1900	100	5·0	1000	50·00	1025·00	...	...	...	...	...
4th October	,,	504	16	405	2000	1890	110	5·5	1015	50·75	1024·50	...	...	...	...	...
11th ,,	,,	489	17	412	2000	1835	165	8·2	1005	50·25	1024·00	...	...	...	...	...
18th ,,	,,	493	18	419	2000	1850	150	7·5	1040	52·00	1024·00	...	...	...	300	1409
23rd ,,	,,	...	...	424	Injected 4050 c.c. V. B. $\left\{\frac{2300}{913}+\frac{1750}{914}\right\}$. Reaction 40·9°C.; *good*, lasting 5 days.											
12th November	,,	511	19 Death	444	4520	4185	355	7·8	1500	33·18	1028·25	...	...	...	150	1471
TOTAL		...	...	...	37970	34965	3005	7·91	18873	44·43	1030·25 1023·50	Max. Min.	...	...	...	...

Simultaneous method, bled, injected with massive dose V. B.

Bull No. 1168 (hill). Age 8 years.

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
29th January 1902	228S. 224M. 228E.	...	1	Inoculated 19 c.c. serum (of 930) + 0·5 c.c. V. B. (1131). Reaction 41°C.; *good*, lasting 6 days.												
1st March ,,	251	1	32	1400	1200	200	14·2	850	46·42	1026·50	...	...	...	90	1320	
10th ,, ,,	235	...	41	Injected 4000 c.c. V. B. $\left\{\frac{800}{1263}+\frac{1800}{1267}+\frac{1600}{1265}\right\}$. Reaction 40·4°C.: *fair*, lasting 4 days.												
8th April ,,	262 267 268	2	70	1500	1410	90	6·0	775	51·66	102·75	10·1360	...	...	125	1893	
15th ,, ,,	277	3	77	1500	1300	200	13·3	835	55·66	1028·00	9·9120	...	...	...	...	
22nd ,, ,,	290	4	84	1500	1295	205	13·8	815	54·33	1027·50	10·1880	...	...	...	...	
29th ,, ,,	279	5	91	1500	1310	190	12·6	840	56·00	1026·25	9·6120	...	...	...	...	
6th May ,,	299	6	98	1500	1360	140	9·3	815	54·33	1028·00	10·1320	...	...	...	...	
13th ,, ,,	308	7	105	1500	1420	80	5·3	840	56·00	1027·25	9·3360	...	...	...	...	
13th ,,	...	...	...	Injected 4000 c.c. V. B. $\left\{\frac{2200}{1452}+\frac{1800}{1451}\right\}$. Reaction 40·3°C.; *fair*, lasting 7 days.												

4th June ,,	313	8	127	1500	1376	125	8·3	830	55·33	1029·00	10·3000	...	...	40	1727 1829
11th ,, ,,	333	9	134	1500	1405	95	6·3	685	39·00	1028·50	10·7320	...	...	...	
18th ,, ,,	330	10	141	1500	1260	240	16·0	560	44·00	1028·75	10·2920	...	...	...	...
25th ,, ,,	337	11	148	1500	1345	155	10·3	785	52·33	1027·75	9·7600	...	...	...	...
2nd July ,,	338	12	155	1500	1410	90	6·0	780	52·00	1028·25	10·0400	...	...	...	...
9th ,, ,,	342	13	162	1500	1130	370	24·6	685	45·66	1028·25	10·2000	...	...	...	...
19th ,, ,,	351	...	172	Injected 4000 c. c. V. B. $\left\{\frac{2000}{1745}+\frac{2000}{1677}\right\}$. Reaction 40·3°C.: *fair*, lasting 7 days.											
8th August ,,	333	14	192	1500	1376	125	8·3	785	52·33	1029·75	10·6180	...	...	40	1726 1831
15th ,, ,,	342	15	199	1500	1290	210	14·0	785	52·33	1029·25	10·3280	...	...	...	
22nd ,, ,,	354	16	206	1500	1400	100	6·6	800	53·33	1027·25	10·1280	...	...	...	...
29th ,, ,,	348	17	213	1500	1335	165	11·0	735	49·00	1028·00	9·5400	...	...	...	...
6th September ,,	360	18	220	1600	1315	185	12·3	715	47·66	1027·50	9·3920	...	...	...	...
12th ,, ,,	357	19	227	1500	1425	75	5·0	735	49·00	1027·60	9·3360	...	...	...	...
18th ,, ,,	347	...	...	Injected 4000 c.c. V. B. $\left\{\frac{1600}{1851}+\frac{1900}{1837}+\frac{500}{1843}\right\}$. Reaction 41°C.; *good*, lasting 5 days.											
14th October ,,	365	20	259	1500	1275	225	15·0	605	40·33	1028·75	10·9760	...	...	150	2304 2405
21st ,, ,,	372	21	266	1500	1385	115	7·6	675	45·00	1028·50	10·2240	...	...	...	...
26th ,, ,,	...	22	271	5265	4785	480	9·1	1565	29·72	1026·25	8·0440	...	...	...	...
	Discontinued.														
TOTAL	...	...	...	36665	32805	3860	10·5	17595	47·98	1029·75 1026·25	Max. Min.	...	...	...	...

Simultaneous method followed by one injection, V. B.

Bull No. 1000 (hill). Age 3½ years.

29th November 1901	208	...	1	Inoculated 52 c.c. serum (No. XI) + 0·5 c.c. V. B. (994). Reaction 41·6°C.; *good*, lasting 6 days.
27th December ,,	201	...	29	Injected 3220 c.c. V. B. $\left\{\frac{900}{1076}+\frac{2320}{1079}\right\}$. Reaction 40·8°C.; *good*, lasting 7 days.

Simultaneous method followed by one injection, V. B.—continued.

Bull No. 1000 (hill). Age 3½ years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c	c.c.			c.c.		c.c.		
18th January 1902	200	1	51	1000	930	70	7·0	520	52·00	1027·25	10·0980	...	...	40	1228 1195	
25th „ „	212	2	58	1000	940	60	6·0	550	55·00	1026·50	8·0100	...	...	...	...	
31st „ „	202 Death.	3	64	3820	3100	220	6·6	1900	57·22	1025·25	9·6180	...	...	...	...	
TOTAL	...	...	...	5320	4970	350	6·5	2970	55·82	1027·25 1025·25	Max. Min.	...	...	..	...	

Bull No. 1001 (hill). Age 2 years.

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE. Amount.	FIBRINE. Per cent.	SERUM. Quantity.	SERUM. Per cent.	Specific gravity of pure serum.	Percentage of total proteids in serum.	PLAINS BREED. Dose.	PLAINS BREED. No. of animal.	HILL BREED. Dose.	HILL BREED. No. of animal.	REMARKS.
29th November 1901	180		1	Inoculated 54 c.c. serum (No. IX) + 0·5 c.c. V. B. (994). Reaction 40·9°C.; *good*, lasting 2 days.												
27th December „	192		29	Injected 3400 c.c. V. B. $\left\{\frac{2290}{1044}+\frac{1110}{1076}\right\}$. Reaction 41°C.; *good*, lasting 14 days.												
17th January 1902	194	1	50	800	715	85	10·6	215	26·87	1027·00	9·4360	...	...	60	1186 1229	
24th „ „	190	2	57	800	705	95	11·6	340	42·50	1026·00	10·3760	...	...	...	...	
31st „ „	185	3 Death	64	3170	2810	360	11·3	1415	44·63	1025·00	8·8600	...	...	...	...	
TOTAL	...	...	...	4770	4230	540	11·3	1970	41·29	1027·00 1025·00	Max. Min.	...	...	...	...	

Bull No. 1236 (hill). Age about 6 years.

22nd February	1902	239E. 251M. 245E.		1	Inoculated 35·75 c.c serum (of 729) + 0·5 c.c. V. B. (1222). Reaction 40·7°C.; *good*, lasting 1 day.											
13th March	,,	239	...	20	Injected 3300 c.c. V. B. $\left\{\frac{2050}{1269}+\frac{1250}{1270}\right\}$. Reaction 40·9°C.; *good*, lasting 6 days.											
4th April	,,	257	1	42	1300	1015	280	21·9	545	41·92	1029·00	10·1560	...	...	50	1898
11th ,,	,,	254	2	49	1300	1160	140	10·7	295	22·69	1028·25	9·9840	...	...	...	...
18th ,,	,,	253	3	56	1300	975	325	25·0	535	41·15	1027·75	9·6760	...	...	...	...
24th ,,	,,	260	...	63	Injected 4000 c. c. V. B. $\left\{\frac{1500}{1872}+\frac{2500}{1393}\right\}$. Reaction 39·8°C.; *nil*.											
15th May	,,	287	4	84	1300	1190	110	8·4	595	45·76	1028·75	10·0780	...	...	...	...
22nd ,,	,,	261	5	91	1300	1230	70	5·3	555	42·69	1028·00	10·4800	...	...	...	...
29th ,,	,,	268	6	98	1300	1185	115	8·3	550	42·30	1028·50	10·4160	...	...	...	...
5th June	,,	286	7	105	1300	1195	105	8·0	555	42·69	1028·75	10·5500	...	...	...	...
12th ,,	,,	293	8	112	1300	1175	125	9·6	595	45·76	1026·75	8·9120	...	...	...	...
19th ,,	,,	297	9	119	1300	1150	150	11·5	545	41·92	1026·00	9·0340	...	...	...	...
4th July	,,	...	...	134	Injected 3000 c.c. V. B. $\left\{\frac{1200}{1563}+\frac{1800}{1571}\right\}$. Reaction 39·8°C.; *nil*.											
24th ,,	,,	295	10	154	1300	1130	170	13·0	442	32·46	1028·50	10·4040	...	...	...	...
31st ,,	,,	300	11	161	1300	1185	115	8·8	475	86·53	1028·25	9·2680	...	...	...	...
7th August	,,	307	12	168	1300	1100	200	15·3	500	38·46	1027·25	8·5620	...	...	...	...
14th ,,	,,	290	13	175	1300	1005	295	22·8	465	35·76	1027·50	9·4000	...	...	...	...
21st ,,	,,	298	14	182	1300	1045	255	19·6	560	43·07	1026·00	9·0600	...	...	...	...
28th ,,	,,	313	15	189	1900	1150	150	11·5	495	38·07	1027·00	9·4700	...	...	...	...

Simultaneous method followed by one injection, V. B.—concluded.

Bull No. 1236 (hill). Age about 6 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c. c.		
29th August 1902	...	...	190	Injected 4000 c.c. V. B. $\left\{\frac{1800}{1789}+\frac{1500}{1784}+\frac{700}{1714}\right\}$. Reaction 40·3°C.; *fair*, lasting 2 days.												
22nd September ,,	337	16	214	1500	1380	120	8·0	395	26·33	1029·25	11·5280	...	...	...	...	
29th ,, ,,	327	17	221	1500	1355	145	9·6	540	36·00	1028·25	10·0760	...	...	...	...	
6th October ,,	382	18	228	1500	1400	100	6·6	535	35·66	1028·75	10·5680	...	...	...	...	
13th ,, ,,	333	19	235	1500	1385	115	5·2	605	40·33	1026·75	9·2280	...	...	...	...	
20th ,, ,,	354	20	242	1500	1350	150	10·0	565	37·66	1027·75	9·7360	...	...	...	...	
27th ,, ,,	...	21	249	4389	3990	399	9·0	1765	40·21	1025·25	7·8000	...	...	...	...	
	Discontinued.															
TOTAL	...	...	...	31389	27750	3639	11·5	12092	38·52	1029·25 1025·25	Max. Min.	...	...	...	...	

Simultaneous method, retested V. B. after 220—246 days followed by one large injection of V. B.

Bull No. 451 (hill). Age 6 years.

17th August 1900 . .	245	...	...	Inoculated 30·6 c.c. serum (of 352) + 0·5 c.c. V. B. Reaction 39·5°C.; *nil*.											
20th April 1901 . .	240	...	247	Inoculated 1 c.c. V. B. (615). Reaction 39·5°C.; *nil*.											
18th May " . .	269	...	275	Injected 4620 c.c. V. B. $\left\{\frac{2300}{670}+\frac{2320}{676}\right\}$. Reaction 40·5°C.; *fair*, lasting 3 days.											
8th June " . .	291	1	296	1000	940	60	6·0	450	45·00	1024·00	...	...	...	15	1187 1112
9th " " . .	291	...	297	Injected 3550 c.c. V. B. $\left\{\frac{1500}{598}+\frac{2050}{699}\right\}$. Reaction 39·7°C.; *nil*.											
1st July " . .	290	2	320	1100	960	140	12·7	500	45·45	1026·25	...	...	...	15	1192 1110
8th " " . .	278	3	327	1000	910	90	8·0	490	49·00	1026·00	...	...	...	...	...
15th " " . .	292	4	334	1100	950	150	13·6	610	55·45	1025·50	...	...	...	...	...
22nd " " . .	290	5	341	1100	1020	80	7·2	570	51·81	1026·50	...	...	...	...	...
29th " " . .	298	6	348	1100	1015	85	7·7	450	43·63	1028·00	...	...	...	...	...
5th August " . .	304	7	355	1100	995	105	9·5	525	47·72	1026·25	...	...	...	120	1369
8th " " . .	...	...	358	Injected 5000 c.c. V. B. $\left\{\frac{3000}{781}+\frac{3000}{782}\right\}$. Reaction 40·2°C.; *fair*, lasting 7 days.											
31st " " . .	311	8	381	1100	995	105	9·5	545	49·54	1026·00	...	...	...	90	1445
7th September " . .	322	9	388	1100	1015	85	7·7	510	46·36	1028·00	...	...	...	...	...
14th " " . .	320	10	395	1100	1020	80	7·2	550	50·00	1025·00	...	...	...	...	...
21st " " . .	333	11	402	1100	1030	70	6·3	615	55·90	1024·00	...	...	...	...	...
27th " " . .	323	12	408	1100	1000	100	9·0	580	52·72	1026·00	...	...	...	...	...
4th October " . .	346	13	415	1100	1020	80	7·2	510	46·36	1025·50	...	...	...	...	...

Simultaneous method, retested V. B. after 222—246 days followed by one large injection of V. B.—contd.

Bull No. 451 (hill). Age 6 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
						Amount.	Per cent	Quantity.	Per cent.			PLAINS BREED.		HILL BREED.		
												Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c°c.	c.c.			c. c.		c.c.		
8th October 1901 . .	...	...	419	Injected 4750 c.c. V. B. $\left\{\frac{2510}{892}+\frac{2240}{891}\right\}$. Reaction 40·3°C.; *fair*, lasting 8 days.												
31st ,, ,, . .	343	14	442	1100	1030	70	6·3	480	43·63	1030·00	...	...	...	30	1489 1437	
7th November ,, . .	348	15	449	1100	1015	65	7·7	360	32·72	1028·00	...	...	...	...	...	
14th ,, ,, . .	351	16	456	1100	1025	75	6·8	500	45·45	1026·00	...	...	...	...	...	
21st ,, ,, . .	355	17	463	1100	1040	60	5·4	495	45·00	1027·00	...	...	...	...	...	
28th ,, ,, . .	351	18	470	1100	990	110	10·0	485	44·09	1026·00	...	...	...	...	...	
5th December ,, . .	348	19	477	1100	1020	80	7·2	440	40·00	1027·25	...	...	...	...	...	
6th ,, ,, . .	...	...	478	Injected 4000 c.c. V. B. $\left\{\frac{2100}{1005}+\frac{1900}{1007}\right\}$. Reaction 40·5°C.; *fair*, lasting 1 day.												
26th ,, ,, . .	354	20	408	1100	920	180	16·3	440	40·00	1029·25	...	...	...	150	1487	
2nd January 1902 . .	346	21	505	1100	1035	65	5·9	255	23·18	1027·50	...	...	...	...	...	

9th ,, ,,	349	22	512	1100	830	270	24·5	340	30·90	1028·00	...	...	...	...	...
16th ,, ,,	360	23	519	1100	1005	95	8·6	335	30·45	1026·25	...	...	...	...	...
23rd ,, ,,	360	24	526	1100	1030	70	6·3	590	53·63	1025·75	...	...	...	...	...
30th ,, ,,	364	25	533	4090	3700	390	9·5	1820	44·49	1024·75	...	...	...	...	...
30th ,, ,,	360	...	Death	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	...	...	...	30290	27510	2780	9·1	13475	44·48	1030·00 1024·00	Max. Min.	...	...	...	...

Bull No. 500 (hill). Age 3 years.

12th September 1900	202	...	1	Inoculated 16·83 c. c. (serum of 77) + 0·5 c.c. V. B. (495). Reaction 40·1°C.; *fair*, lasting 2 days.											
20th April 1901	260	...	221	Inoculated 1 c.c. V. B. (6·5). Reaction 39·3°C.; *nil.*											
2nd May ,,	292	...	233	Injected 7700 c.c. V. B. $\left\{\frac{3700}{623}+\frac{4000}{624}\right\}$. Reaction 41·2°C.: *good*, lasting 16 days.											
1st June ,,	284	1	263	1000	895	115	11·5	500	50·00	1023·50	...	...	...	120	1542 1355
6th ,, ,,	289	2	270	1100	950	150	13·6	565	51·36	1022·50	...	...	...	...	...
14th ,, ,,	291	3	276	1100	975	125	11·3	630	57·27	1024·25	...	...	...	...	...
14th ,, ,,	...	...	...	Injected 4800 c.c. V. B. $\left\{\frac{1875}{700}+\frac{2925}{701}\right\}$. Reaction 40·9°C.; *good*, lasting 6 days.											
9th July ,,	284	4	301	1100	960	140	12·5	630	57·27	1026·00	...	...	...	...	...
16th ,, ,,	304	5	308	1100	915	185	16·8	563	51·63	1027·00	...	...	...	...	...
23rd ,, ,,	303	6	315	1100	1000	100	9·0	490	44·54	1026·50	...	...	...	...	...
30th ,, ,,	299	7	322	1100	965	135	12·2	510	46·36	1024·25	...	...	...	...	...
6th August ,,	312	8	329	1100	990	110	10·0	540	49·09	1025·50	...	...	...	...	...
13th ,, ,,	305	9	336	1100	980	120	10·9	600	54·54	1026·00	...	...	...	...	...

Simultaneous method, retested V. B. after 220—246 days followed by one large injection of V. B.—concld.

Bull No. 500 (Hill). Age 3 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	-16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
14th August 1901	...	...	337	Injected 6500 c.c. V.B. $\left\{\frac{4400}{733}+\frac{100}{791}\right\}$. Reaction 40·8°C.; *good*, lasting 8 days.												
5th September "	343	10	359	1100	940	160	14·5	580	52·72	1026·00	...	...	...	...	...	
12th " "	339	11	366	1100	980	120	10·9	630	57·27	102[illegible]·00	...	...	...	...	...	
19th " "	347	12	373	1100	1020	80	7·2	650	59·09	1023·25	...	...	...	...	...	
26th " "	340	13	380	1100	980	120	10·9	570	51·81	1024·50	...	...	...	...	...	
3rd October "	359	14	387	1100	990	110	10·0	660	60·00	1023·75	...	...	...	...	...	
10th " "	359	15	394	1100	990	110	10·0	605	55·00	1023·50	...	...	...	...	...	
13th " "	...	...	397	Injected 2865 c.c. V. B. (908) Injected 2360 c.c. V. B. (907) }. Reaction 40·5°C.; *fair*, lasting 6 days.												
14th " "	...	...	398													
2nd November "	375	16	417	1100	990	110	10·0	500	45·45	1026·00	...	...	...	...	...	
9th " "	371	17	424	1100	1015	85	7·7	300	27·27	1028·50	...	...	...	...	...	

18th ,,	,,	388	18	431	1100	1030	70	6·3	605	55·00	1027·00	...	...	...	...	...
23rd ,,	,,	373	19	438	1100	1030	70	8·3	640	49·09	1028·25	...	...	...	...	...
30th ,,	,,	387	20	445	1100	920	180	16·3	460	41·81	1027·00	...	...	...	...	...
7th December	,,	371	21	452	1100	995	105	9·5	620	47·27	1025·00	...	...	...	...	...
11th ,,	,,	...	...	458	Injected 4400 c. c. V. B. $\left\{\frac{2650}{1014}+\frac{1750}{1016}\right\}$. Reaction 41·6°C.; *good*, lasting 8 days.											
31st ,,	,,	384	22	476	1100	950	150	13·6	215	19·54	1020·00	...	...	...	...	...
7th January	1902	377	23	483	1100	890	210	19·0	475	43·18	1027·00	...	...	...	...	...
14th ,,	,,	383	24	490	1100	1010	90	8·1	636	48·63	1028·00	...	...	...	...	...
21st ,,	,,	376	25	497	1100	1010	90	8·1	600	45·45	1025·25	...	...	...	...	...
28th ,,	,,	377	28	504	1100	1000	100	9·0	545	49·54	1024·50	...	...	...	...	...
4th February	,,	385	27	511	4850	4320	530	10·9	2355	48·55	1023·00	...	...	...	...	...
4th ,,	,,	371		Death.												
TOTAL		...	...	...	33350	29880	3670	11·0	18278	48·80	1023·50 1022·50	Max. Min.	...	...	...	...

Simultaneous method followed by two injections of V. B. three bleedings between first and second doses V. B.

Bull No. 352 (hill). Duplicate of No. 900. Age 6 years.

5th May	1900	267	...	1	Inoculated 89 c.c. (serum No. V11) +0·5 c.c. V. B. (391). Reaction 40·8°C.; *good*, lasting 6 days.											
22nd ,,	,,	278	...	18	Injected 3000 c.c. V. B. $\left\{\frac{750}{380}+\frac{2250}{356}\right\}$. Reaction 40·9°C.: *good*, lasting 8 days.											
5th June	,,	270	1	32	600	485	115	19·1	290	48·33	1023·50	...	14	...	250	1165 1097
12th ,,	,,	285	2	39	1000	850	160	15·0	520	52·00	1028·25	...	...	...	...	...
19th ,,	,,	281	3	46	1000	840	160	16·0	485	48·50	1028·00	...	18·6	...	300	1332

Simultaneous method followed by two injections of V. B. three bleedings between first and second doses V. B.—continued.

Bull No. 352 (hill). Duplicate of No. 900. Age 6 years—*continued.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
27th June 1900 . .	280	...	64	Injected 3300 c.c. V. B. $\left\{\frac{2700}{394}+\frac{600}{392}\right\}$. Reaction 41·0°C.; *good*, lasting 9 days.												
16th July ,, . .	288	4	73	1000	880	120	12·0	410	41·00	1028·50	...	0·55	...	10	514 1000	This serum retested after 13 months—still retains the same degrees of protective power.
23rd ,, ,, . .	302	5	80	1200	1065	135	11·2	445	37·08	1027·00	...	...	...	...	...	
30th ,, ,, . .	302	6	87	1200	1050	150	12·5	525	43·75	1026·00	...	...	...	...	...	
6th August ,, . .	311	7	94	1200	1120	80	6·6	676	56·25	1026·25	...	...	...	...	...	
13th ,, ,, . .	323	8	101	1300	1110	190	14·6	630	48·46	1024·00	...	...	...	...	...	
20th ,, ,, . .	336	9	108	1400	1245	155	11·0	735	52·50	1025·25	...	5·5	...	100	764	
27th ,, ,, . .	314	10	115	1200	1110	90	7·5	640	53·33	1026·00	...	...	...	...	...	
3rd September ,, . .	332	11	122	1400	1080	320	22·8	700	50·00	1025·00	...	...	...	...	...	
10th ,, ,, . .	359	12	129	1400	clotted	in glass	...	580	41·42	1025·00	...	...	...	...	...	
17th ,, ,, . .	376	13	136	1300	11.0	110	8·4	695	53·46	1024·00	...	...	...	...	...	

4th September 1900	371	14	143	1400	1200	200	14·2	770	55·00	1023·25	...	...	...	...
1st October ,,	344	15	150	1300	1120	160	13·8	675	51·92	1023·25	16·6	...	300	803
1st November ,,	339	16	181	600	clotted	in glass	...	190	31·66	1027·50	...	...	...	...
1st December ,,	324	17	211	1000	925	75	7·5	315	31·50	1027·00	...	...	...	...
1st January 1901	323	18	242	1000	920	80	8·0	325	32·50	1026·00	...	...	...	...
1st February ,,	313	19	273	1000	910	90	9·0	405	40·50	1026·00	...	...	...	...
1st March ,,	333	20	202	1200	1120	80	6·6	345	28·75	1025·50	...	...	...	...
1st April ,,	343	21	233	1200	1120	80	6·6	440	36·66	1025·00	22·2	...	400	854
26th ,, ,,	310	...	258	Injected 6500 c.c. V. B. $\left\{\frac{3550}{666}+\frac{2850}{603}\right\}$. Reaction 41·4°C.; *good*, lasting 5 days.										
16th May ,,	351	22	278	1400	1270	130	9·2	555	39·64	1026·25	...	...	20	1316 1446
23rd ,, ,,	345	23	25	1400	1340	60	4·2	630	45·00	1026·00	...	...	...	...
30th ,, ,,	343	24	292	1400	1200	200	14·2	665	47·50	1023·50	...	...	...	...
6th June ,,	369	25	299	1400	1200	200	14·2	680	48·57	1022·00	...	...	...	...
13th ,, ,,	357	26	306	6400	1220	180	12·8	695	49·64	1023·00	...	...	...	...
20th ,, ,,	363	27	313	1400	1205	195	13·9	790	56·42	1022·50	...	No serum kept.		
19th August ,,	365	...	373	Injected 3500 c.c. V. B. $\left\{\frac{1800}{795}+\frac{1700}{786}\right\}$. Reaction 40·6°C.; *good*, lasting 5 days.										
5th September ,,	...	...	390	Injected 6265 c.c. V. B. $\left\{\frac{3520}{816}+\frac{2740}{815}\right\}$. Reaction 40·2°C.; *good*, lasting 9 days.										
25th ,, ,,	391	28	410	1100	985	115	10·4	450	40·90	1030·00	...	...	30	1325
1st October ,,	373	29	416	1100	980	120	10·9	465	42·27	1020·00	...	...	...	...
8th ,, ,,	392	30	423	1400	1270	130	9·2	555	39·64	1029·00	...	...	...	...
15th ,, ,,	412	31	430	1500	1355	145	9·6	760	50·66	1023·50	...	...	...	...

Simultaneous method followed by two injections of V. B. three bleedings between first and second doses V. B.—continued.

Bull No. 352 (hill). Duplicate of No. 900. Age 6 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentages of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
22nd October 1901 . .	420	32	437	1500	1340	160	10·6	795	53·00	1025·75		...	...	...	...	
29th ,, ,, . .	429	33	444	1500	1330	170	11·3	725	48·33	1027·25		...	...	200	1241	
October ,, . .	...	Disco	ntinus	d.												
TOTAL .	...	...	...	40400	34035	4365	10·8	17560	43·46	1030·0 1022·0	Max. Min.					

Bull No. 900 (hill). Age 6 years.

7th October 1901 . .	288 S. 276 M. 288 E.	...	...	Inoculated 57·6 c.c. serum (No. X) + 0·5 c. c. V. B. (891). Reaction 40·8°C.; *good*, lasting 4 days.
2nd November ,, . .	248	...	27	Injected 3000 c.c. V. B. $\left\{\frac{1600}{921}+\frac{1400}{922}\right\}$. Reaction 40·6°C.; *good*, lasting 8 days.

16th ,, ,, . .	266	1	41	850	615	35	5·3	380	58·46	1027·25	8·5240	...	...	30	1293	
23rd ,, ,, . .	265	2	48	1000	865	135	13·5	500	50·00	1027·00	9·0680	...	...	...	...	
30th ,, ,, . .	272	3	55	1000	920	80	8·0	495	49·50	1026·50	8·0680	...	...	80	1411	
30th ,, ,, . .	...	...	...	Injected 3300 c.c. V. B. $\left\{\frac{2950}{994}+\frac{350}{986}\right\}$. Reaction 40·8°C.; *good*, lasting 7 days.												
19th December ,, . .	261	4	74	1000	890	110	11·0	485	48·50	1027·00	7·9600	...	...	15	1186	
26th ,, ,, . .	254	5	81	1200	1085	115	0·5	575	47·91	1028·25	9·1800	...	...	...	...	
2nd January 1902 . .	253	6	88	1200	1110	90	7·5	605	50·41	1024·00	7·9600	...	...	...	...	
9th ,, ,, . .	251	7	95	1200	1070	130	10·8	570	47·50	1025·25	7·7200	...	...	...	...	
18th ,, ,, . .	247	8	102	1300	1145	155	11·9	535	41·15	1024·25	7·3500	...	...	...	...	
23rd ,, ,, . .	222	9	109	1400	1300	100	7·1	775	55·35	1024·50	7·1080	...	...	100	1383 1528	
24th ,, ,, . .	...	...	110	Injected 4000 c.c. V. B. $\left\{\frac{1350}{1132}+\frac{1850}{1125}+\frac{800}{1123}\right\}$. Reaction 40·9°C ; *good*, lasting 8 days.												
14th February ,, . .	245	10	131	1400	1270	130	9·2	620	44·28	1028·25	10·2500	...	...	23	1365 1417	
21st ,, ,, . .	253	11	138	1400	1080	320	22·8	620	44·28	1023·50	8·5600	...	...	...	...	200 c.c. clotted in glass.
28th ,, ,, . .	255	12	145	1400	1240	120	8·5	730	52·14	1023·00	8·2300	...	...	...	...	
7th March ,, . .	258	13	152	1400	1280	120	8·5	740	52·85	1023·00	8·3520	...	...	...	...	
14th ,, ,, . .	259	14	159	1400	1300	100	7·1	730	52·14	1023·50	9·2000	...	...	...	...	
21st ,, ,, . .	276	15	166	1400	1305	95	6·7	710	50·71	1024·00	8·3020	...	...	150	1371	
21st ,, ,, . .	...	...	...	Injected 4500 c.c. V. B. $\left\{\frac{2400}{1328}+\frac{2100}{1302}\right\}$. Reaction 41°C.; *good*, lasting 6 days.												
12th April ,, . .	270	16	188	1400	1270	130	9·3	655	46·82	1025·25	9·2960	...	...	30	1542	
19th ,, ,, . .	270	17	195	1400	1215	185	13·2	690	49·28	1024·25	8·8720	...	...	...	...	
28th ,, ,, . .	287	18	202	1400	1210	190	13·5	685	48·92	1025·25	9·0720	...	...	...	...	
3rd May ,, . .	298	19	209	1400	1250	150	10·7	780	55·71	1022·75	8·2580	...	...	...	...	

Simultaneous method followed by two injections of V. B. three bleedings between first and second doses V. B.—concluded.

Bull No. 900 (hill). Age 6 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
10th May 1902 . .	301	20	216	1400	1250	150	10·7	785	56·07	1024·50	8·7480	...	...	...	...	
17th " " . .	305	21	223	4690	4200	490	10·4	2765	53·95	1023·00	8·5820	...	...	175	1579	
17th " " . .	Death															
TOTAL .	...	...	...	30040	26910	3130	10·4	15430	51·36	1028·25 1022·75	Max. Min.	...	...	...	...	

Simultaneous method followed by two injections of V. B., second larger than the first.

Bull No. 960 (hill). Age 3 years.

1st November 1901 . .	219 S. 234 M. 226 E.	...		Inoculated 7·53 c.c. serum (of 352) +0·5 c.c. V. B. (921). Reaction 41·2°C.; *good*, lasting 6 days.
26th December " . .	231	...	56	Injected 2000 c.c. V. B. $\left\{\frac{1800}{1043}+\frac{200}{1042}\right\}$. Reaction 40·8°C.; *good*, lasting 5 days.
7th January 1902 . .	231	...	68	Injected 2500 c.c. V. B. $\left\{\frac{1550}{1076}+\frac{950}{1077}\right\}$. Reaction 41·1°C.; *good*, lasting 4 days.

30th ,, ,,	216	1	91	1000	900	100	10·0	530	53·00	1028·00	9·8020	...	...	10	2074
8th February ,,	225	2	100	2910	2620	290	9·9	1660	57·04	1027·00	9·8100	...	...	...	...
8th ,, ,,	216	Death	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	...	...	...	3910	3520	390	9·9	2190	56·01	1026·00 1027·00	Max. Min.	...	...	...	...

Bull No. 1039 (hill). Age 4 years.

21st December 1901	261 S. 262 M. 261 E.	...	1	Inoculated 108·75 c.c. Buf. serum +0·5 V. B. (1038). Reaction 40·2° C.; *fair*, lasting 2 days.											
8th January 1902	273	...	19	Injected 1700 c.c. V. B. (1084, 24 hrs. old). Reaction 40·5° C.; *fair*, lasting 8 days.											
20th ,, ,,	...	...	31	Injected 3300 c.c. V. B. $\left\{\frac{1600}{1127}+\frac{1350}{1126}+\frac{350}{1128}\right\}$. Reaction 41·3°C.; *good*, lasting 7 days.											
11th February ,,	254	1	53	1100	920	180	16·3	590	53·63	1028·00	11·8520	...	...	250	2123
8th ,, ,,	253	2	60	1100	1040	60	5·4	600	54·54	1027·00	9·1640	...	...	...	...
25th ,, ,,	250	3	67	1100	1010	90	8·1	630	57·27	1026·00	8·9680	...	...	...	...
4th March ,,	248	4	74	1100	1000	100	9·0	610	55·45	1025·50	9·0170	...	...	...	...
11th ,, ,,	259	5	81	1100	1000	100	9·0	615	55·90	1025·50	9·6000	...	...	...	...
8th ,, ,,	261	6	88	1100	1010	90	8·1	550	50·00	1027·50	10·6720	...	...	...	...
21st ,, ,,	...	...	01	Injected 1700 c.c. V. B. $\left\{\frac{1500}{1312}+\frac{200}{1302}\right\}$. Reaction 41·2°C.; *good*, lasting 9 days.											
24th April ,,	230	7	125	1100	965	135	12·2	505	45·90	1029·75	10·5600	...	...	240	1947 2076
1st May ,,	256	8	132	1100	1030	70	6·3	580	52·72	1026·00	10·3520	...	...	...	...
10th ,, ,,	274	...	141	Injected 2300 c.c. V. B. (1436). Reaction 41·5°C.; *good*, lasting 6 days.											
31st ,, ,,	286	9	162	1100	1010	90	8·1	595	54·09	1027·25	10·8800	...	...	...	...

Simultaneous method followed by two injections of V. B., second larger than the first—continued.

Bull No. 1039 (hill). Age 4 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
7th June 1902 . .	280	10	169	1100	1000	100	9·0	595	54·09	1027·25	11·4640	...	...	...	...	
14th „ „ . .	294	11	176	1100	990	110	10·0	575	52·27	1025·75	9·8160	...	...	...	...	
21st „ „ . .	292	12	183	1100	1000	100	9·0	555	50·45	1027·50	10·8200	...	...	...	...	
28th „ „ . .	297	13	190	1100	1000	100	9·0	470	42·72	1025·00	10·1560	...	...	...	...	
5th July „ . .	302	14	197	1100	950	150	13·6	495	45·00	1027·25	11·2360	...	...	...	...	
17th „ „ . .	298	...	209	Injected 3400 c.c. V. B. $\left\{\frac{1900}{1755}+\frac{1500}{1749}\right\}$. Reaction 40·5°C.; *fair*, lasting 6 days.												
6th August „ . .	291	15	229	1100	955	145	13·1	525	47·72	1027·75	9·9160	...	...	...	...	
13th „ „ . .	298	16	236	1100	910	190	17·2	515	46·81	1027·00	9·3080	...	...	...	...	
21st „ „ . .	310	17	244	1100	1015	85	7·7	560	50·90	1020·50	9·0600	...	...	...	...	
27th „ „ . .	301	18	250	1100	960	140	12·7	565	51·36	1028·25	9·6000	...	...	...	...	
4th September „ . .	327	19	258	1100	950	150	13·6	495	45·00	1026·25	9·0480	...	...	...	...	
11th „ „ . .	311	Death														
TOTAL .	...	...	...	20900	18715	2185	10·4	10625	50·83	{1029·75 {1025·00	Max. Min.	} ...	...	...	...	

Bull No. 992 (hill). Age 3 years.

3rd December 1901	282	...	1	Injected 100 c.c. serum (No. X). Reaction 39·9°C.; *poor*, lasting 1 day.											
14th ,, ,,	281	...	43	Injected 2500 c.c. V. B. (1013). Reaction 40·4°C.; *fair*, lasting 6 days.											
1st January 1902	276	...	61	Injected 2600 c.c. V. B. $\left\{\frac{600}{1052}+\frac{2000}{1058}\right\}$. Reaction 39·8°C.; *nil*, lasting 4 days.											
22nd ,, ,,	305	1	82	1300	1200	100	7·7	400	30·77	1026·00	10·9410	...	...	180	1735 1987
29th ,, ,,	281	2	89	1300	1180	120	8·2	465	35·76	1027·50	10·9920	...	...	...	...
5th February ,,	293	3	96	1300	1175	125	8·6	545	41·92	1026·50	8·6300	...	...	...	...
12th ,, ,,	283	4	103	1300	1180	120	9·2	540	41·53	1036·00	9·2630	...	...	...	...
19th ,, ,,	308	5	110	1300	1170	130	10·0	580	44·61	1025·25	9·0400	...	...	...	...
26th ,, ,,	299	6	117	1300	1190	110	8·4	600	46·15	1025·50	8·7660	...	...	...	...
27th ,, ,,	...	...	118	Injected 3000 c.c. V. B. $\left\{\frac{1250}{1249}+\frac{1750}{1226}\right\}$. Reaction 40·4°C.; *fair*, lasting 3 days.											
19th March ,,	315	7	138	1400	1305	95	6·7	630	45·00	1036·25	9·2840	...	...	400	...
26th ,, ,,	297	8	145	1400	1280	120	8·5	690	49·28	1025·75	8·5240	...	...	...	...
2nd April ,,	301	9	152	1400	1215	185	13·2	660	47·14	1023·00	9·4240	...	...	...	...
9th ,, ,,	308	10	159	1500	1270	230	15·3	745	49·66	1025·00	7·8720	...	...	...	...
16th ,, ,,	323	11	166	1500	1300	200	13·3	705	47·00	1026·25	8·9440	...	...	...	...
23rd ,, ,,	335	12	173	1500	1385	115	7·6	675	45·00	1025·75	8·8600	...	...	...	...
29th ,, ,,	325	...	179	Injected 3500 c.c. V. B. $\left\{\frac{2000}{1402}+\frac{1500}{1400}\right\}$. Reaction 40·2°C. *Nil.*											
26th May ,,	354	13	206	1500	1315	185	11·0	595	39·66	1027·75	10·3920	...	...	100	2071
2nd June ,,	352	14	213	1500	1410	90	6·0	750	50·00	1025·75	9·3140	...	...	...	...
9th ,, ,,	352	15	220	1500	1350	150	10·0	665	44·33	1028·25	8·5280	...	...	...	...

Simultaneous method followed by two injections of V. B., second larger than the first—continued.

Bull No. 992 (hill). Age 3 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
						Amount.	Per cent.	Quantity.	Per cent.			PLAINS BREED.		HILL BREED.		
												Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
16th June 1902 . .	361	16	227	1500	1345	155	10·3	625	41·66	1026·25	8·2760	...	...	...	...	
23rd ,, ,, . .	338	17	234	1500	1325	175	11·6	695	46·33	1025·75	8·7840	...	...	...	...	
30th ,, ,, . .	340	18	241	1500	1240	260	17·3	620	41·33	1024·25	9·1400	...	...	...	...	
14th July ,, . .	360	...	255	Injected 4000 c.c. V. B. $\left\{\frac{1500}{1744}+\frac{2200}{1740}+\frac{300}{1751}\right\}$. Reaction 39·8° C.; *nil*, lasting 6 days.												
4th August ,, . .	342	19	276	5900	5290	610	10·3	2070	35·10	1028·00	8·6000	...	...	60	2100	
	338	Death	...	...	...	...	...	...	...	...	...	...	...	...	...	
TOTAL .	...	...	...	31400	28145	3255	10·3	13255	42·21	1028·00 1024·25	Max. Min.	...	...	...	...	

Bull No. 991 (hill). Age 4½ years.

3rd December 1901	302	...	1	Injected 100 c.c. serum (No. X) + Natural Infection. Reaction 41·6°C.; *good*, lasting 2 days.											
13th ,, ,,	...	...	11	Injected 1900 c.c. V. B. (1017). Reaction 40·4°C.; *fair*, lasting 4 days.											
31st ,,	...	...	27	Injected 41 00 c.c. V. B. $\left\{\frac{1680}{1056}+\frac{1850}{1050}+\frac{570}{1052}\right\}$. Reaction 40·5°C.; *fair*, lasting 6 days.											
22nd January 1902	301	1	49	1300	1200	100	7·7	660	50·77	1025·50	8·3540	...	...	45	1:9: 1696
29th ,, ,,	301	2	56	1300	1200	100	7·7	700	53·84	1025·00	8·2760	...	...	...	...
5th February ,,	311	3	63	1300	1180	120	9·2	700	53·84	1025·00	9·9100	...	...	...	...
12th ,, ,,	302	4	70	1300	1170	130	10 0	620	47·69	1024·75	9·4800	...	...	...	...
19th ,, ,,	309	5	77	1300	1150	150	11·6	730	56·15	1025·00	9·6610	...	...	...	...
26th ,, ,,	319	6	84	1300	1130	120	9·2	716	55·00	1026·00	8·8380	...	...	...	...
4th March ,,	...	...	90	Injected 3900 c.c. V. B. $\left\{\frac{2300}{1254}+\frac{1600}{1251}\right\}$. Reaction 41°C.; *good*, lasting 3 days.											
28th ,, ,,	329	7	114	1500	1380	120	8·0	700	46·66	1026·00	9·8680	...	...	40	1593
4th April ,,	337	8	121	1500	1140	360	24·0	715	47·66	1027·00	9·2400	...	...	...	...
11th ,, ,,	340	9	128	1500	1400	100	6·6	725	48·33	1027·25	9·0600	...	...	...	...
18th ,, ,,	339	10	135	1500	1300	200	13·3	745	49·66	1027·50	9·8720	...	...	...	...
25th ,, ,,	352	11	142	1500	1405	95	6·3	725	48·33	1028·25	10·1100	...	...	...	...
2nd May ,,	360	12	149	1500	1370	130	8·6	760	50·66	1025·00	9·8540	...	...	...	...
2nd ,, ,,	...	...	...	Injected 2700 c.c. V. B. (1423) ,, 800 c.c. V. P. (1427) } Reaction 40·5°C.; *fair*, lasting 3 days.											
3rd ,, ,,	...	...	150												
27th ,, ,,	375	13	174	1500	1295	205	13·6	645	43·00	1026·25	9·1880	...	...	112	1684 1722
3rd June ,,	399	14	181	1600	1445	55	3·6	740	49·33	1026·50	9·3860	...	...	...	...
10th ,, ,,	392	15	188	1500	1390	110	7·3	675	45·00	1027·00	9·2940	...	...	...	...
17th ,, ,,	402	16	195	1500	1435	65	4·3	750	50·00	1026·75	9·3500	...	...	...	..

Simultaneous method followed by two injections of V. B., second larger than the first—continued.

Bull No. 991 (hill). Age 4½ years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine. Amount.	Fibrine. Per cent.	Serum. Quantity.	Serum. Per cent.	Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight. Plains Bred. Dose.	Plains Bred. No. of animal.	Hill Bred. Dose.	Hill Bred. No. of animal.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
24th June 1902 . . .	399	17	202	1500	1280	220	14·6	795	53·00	1025·75	8·6280	...	...	...	...	
1st July „ . . .	403	18	209	1500	1390	110	7·3	675	45·00	1025·75	9·4680	...	...	...	...	
9th „ „ . . .	398	...	217	Injected 3800 c. c. V. B. $\left\{\frac{1900}{1577}+\frac{1900}{1563}\right\}$. Reaction 40·4° C. ; *fair*, lasting 2 days.												
2nd August „ . . .	380	19	241	5480	4950	530	9·8	1820	29·58	1027·50	9·4760	...	...	90	1903	
2nd „ „ . . .	388	Death														
Total ...	...	...	...	31280	28260	3020	9·8	14395	46·01	1028·25 1024·75	Max. Min.	...	...	...	...	

Bull No. 729 (hill). Age 2 years.

19th July 1901 . .	297	...	1	Inoculated 71·50 c. c. serum (No. IX) + 0·5 c.c. V. B. Reaction 40·8°C.; *good*, lasting 8 days.
24th August „ . .	291	...	37	Injected 2650 c.c. V. B. $\left\{\frac{2150}{733}+\frac{100}{\text{Bf. 25}}+\frac{300}{\text{Bf. 26}}+\frac{100}{792}\right\}$. Reaction 40·5°C.; *fair*, lasting 5 days.
	246			
29th „ „ . .	...	...	42	Injected 4165 c. c. V. B. $\left\{\frac{2565}{809}+\frac{1600}{810}\right\}$. Reaction 40·6° C.; *good*, lasting 6 days.

19th September	,,	312 319		63	1100	1000	100	9·0	490	44·54	1025·25	9·3440	...	...	70	1381 1414	
28th ,,	,,	328	2	70	1100	1020	80	7·2	530	48·18	1024·50	8·9700	...	...	...	...	
3rd October	,,	341	3	77	1200	1080	120	10·0	600	50·00	1024·25	8·1460	...	...	...	...	
10th ,,	,,	343	4	84	1200	1080	120	10·0	415	34·58	1024·00	8·1440	...	...	...	...	
17th ,,	,,	359	5	91	1400	1250	150	10·7	550	39·28	1023·75	7·9440	...	...	...	...	370·8 c. c. death; no more serum.
24th ,,	,,	363	6	98	1400	1290	110	7·8	548	38·92	1024·50	8·1620	...	...	...	...	
24th ,,	,,	...	...	...	Injected 5540 c.c. V. B. $\left\{\frac{2340}{916}+\frac{3200}{916}\right\}$. Reaction 40·4°C.; *fair*, lasting 4 days.												
13th November	,,	374	7	118	1500	1400	100	8·6	490	32·66	1028·50	9·3820	...	...	120	1420	
20th ,,	,,	357	8	125	1400	1290	110	7·8	470	33·57	1028·25	8·9440	...	...	...	...	
27th ,,	,,	356	9	132	1400	1325	75	5·3	645	46·07	1025·25	7·5400	...	...	...	...	
4th December	,,	368	10	139	1400	1330	70	5·0	660	47·14	1026·00	7·2120	...	...	...	...	
11th ,,	,,	373	11	146	1400	1210	190	13·5	610	43·57	1024·25	7·2640	...	...	...	...	
18th ,,	,,	364	12	153	1400	1330	70	5·0	625	44·64	1023·50	7·4140	...	...	...	...	
21st ,,	,,	...	...	158	Injected 3750 c.c. V. B. $\left\{\frac{1400}{1038}+\frac{2350}{1037}\right\}$. Reaction 40·5°C.; *fair*, lasting 6 days.												
10th January	1902	370	13	176	1400	1150	250	17·8	510	36·42	1027·75	10·5000	...	...	300	1578 1688	
17th ,,	,,	396	14	183	1400	1275	125	8·9	465	33·21	1026·00	8·3320	...	...	...	...	
24th ,,	,,	375	15	190	1400	1300	100	7·1	700	50·00	1023·75	8·4500	...	...	...	...	
31st ,,	,,	400	16	197	1400	1300	100	7·1	700	50·00	1023·00	8·0220	...	...	...	...	
7th February	,,	390	17	204	1400	1250	120	8·5	730	52·14	1023·00	8·0200	...	...	...	...	
14th ,,	,,	407	18	211	1400	1280	120	8·5	600	42·85	1023·00	8·1440	...	...	...	...	
18th ,,	,,	...	...	215	Injected 3400 c.c. V. B. $\left\{\frac{1400}{1199}+\frac{2000}{1200}\right\}$. Reaction 40·4°C.; *fair*, lasting 1 day.												
10th March	,,	401	19	235	2000	1880	120	8·0	800	40·00	1025·00	9·4240	...	...	400	1891	
17th	,,	416	20	242	2200	2025	175	7·9	1130	51·36	1024·25	9·0520	...	...	...	...	

Simultaneous method followed by two injections of V. B., second larger than the first—continued.

Bull No. 729 (Hill). Age 2 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
24th March 1902	414	21	249	2200	2040	160	7·2	1090	49·57	1024·26	7·6740	...	...	...	...	
31st ,, ,,	414	22	256	2200	2010	190	8·6	940	42·72	1025·25	9·1920	...	...	...	...	
7th April ,,	420	23	263	2200	1925	275	12·5	1035	47·04	1026·50	7·8440	...	...	...	...	
14th ,, ,,	415	24	270	2200	2005	195	8·8	945	42·95	1025·00	7·6360	...	...	...	...	
24th ,, ,,	434	...	280	Injected 4000 c.c. V. B. $\left\{\frac{2000}{1091}+\frac{2000}{1090}\right\}$. Reaction 40·2°C.; *fair*, lasting 4 days.												
14th May ,,	439	25	300	5840	5330	510	8·7	2705	46·31	1027·25	9·2440	...	...	500	1766	
,, ,,	420	Died		...	...	...	...	...	...	...	...	...	...	...	...	
TOTAL	...	...	...	43140	39405	3735	8·8	18980	43·99	1028·50 1023·00	Max. Min.	...	...	...	...	

Bull No. 560 (hill). Age 3 years.

8th November 1900 . .	228	...	...	Inoculated 13·30 c.c. serum (of Buf : 11) + 0·5 c.c. V. B. (556). Reaction 40·3°C. ; *fair*, lasting 4 days.											
27th April 1901 . .	251	...	171	Injected 2800 c.c. V. B. (607). Reaction 41·1°C. ; *good*, lasting 5 days.											
10th May ,, . .	...	...	184	Injected 4700 c.c. V. B. $\left\{\frac{2600}{665}+\frac{2100}{668}\right\}$. Reaction 41·1°C. ; *good*, lasting 7 days.											
31st ,, ,, . .	263	1	205	1000	870	130	13·0	480	48·00	1023·25	...	...	...	75	1234
7th June ,, . .	205	2	212	1200	1100	100	8·3	600	50·00	1021·25	...	...	...	...	...
14th ,, ,, . .	279	3	219	1100	995	105	8·5	530	48·18	1025·00	...	...	...	...	...
21st ,, ,, . .	284	4	228	1200	1075	125	10·4	650	54·16	1023·25	...	...	...	...	...
28th ,, ,, . .	298	5	233	1200	1065	135	11·2	636	44·58	1024·25	...	...	...	...	...
5th July ,, . .	302	6	240	1200	1045	155	12·8	466	38·75	1025·00	...	...	...	180	1343
6th ,, ,, . .	...	...	241	Injected 5500 c.c. V. B. $\left\{\frac{2500}{725}+\frac{3000}{726}\right\}$. Reaction 40·8°C. ; *good*, lasting 8 days.											
27th ,, ,, . .	307	7	262	1200	1050	150	12·5	590	49·16	1026·25	...	...	...	30	1435
3rd August ,, . .	298	8	269	1200	1070	130	10·8	627	52·25	1026·00	...	...	...	...	...
10th ,, ,, . .	281	9	276	1100	895	105	9·5	615	55·90	1025·00	...	...	...	...	...
27th ,, ,, . .	287	10	283	1100	985	115	10·4	590	53·63	1026·25	...	...	...	...	...
24th ,, ,, . .	277	11	290	1100	1000	100	9·0	535	48·63	1025·50	...	...	...	...	...
31st ,, ,, . .	281	12	297	1100	1005	85	8·6	515	46·81	1025·00	...	...	...	...	...
3rd September ,, . .	...	...	300	Injected 4340 c.c. V. B. $\left\{\frac{1975}{814}+\frac{2385}{813}\right\}$. Reaction 40·3°C. ; *fair*, lasting 5 days.											
23rd ,, ,, . .	324	13	320	1100	970	130	11·8	640	49·09	1026·50	...	...	...	...	...
1st October , . .	318	14	328	1100	960	140	12·7	545	49·54	1025·00	...	...	...	...	...
8th ,, ,, . .	315	15	335	1100	980	120	10·9	500	45·45	1025·00	...	...	...	...	...
15th ,, ,, . .	347	18	342	1200	1070	130	10·8	590	49·16	1024·00	...	...	...	...	...

Simultaneous method followed by two injections of V. B., second larger than the first—continued.

Bull No. 560 (hill). Age 3 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteide in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
22nd October 1901	356	17	349	1300	1200	100	7·6	610	46·92	1023·25	...	...	...	...	...	
29th " "	358	18	356	1300	1190	110	8·4	600	46·15	1025·00	...	...	...	...	...	
30th " "	...	...	...	Injected 2050 c. c. V. B. (918). Reaction 40·3°C.; *fair*, lasting 5 days.												
18th November "	364	19	376	1300	1190	110	8·4	555	42·69	1027·25	...	...	...	...	...	
25th " "	362	20	383	1300	1195	105	8·0	660	50·76	1026·25	...	...	...	...	...	
2nd December "	351	21	390	1300	1205	95	7·3	560	43·07	1024·25	...	...	...	...	...	
9th " "	347	22	397	1300	1150	150	11·5	615	47·30	1024·25	...	...	...	...	...	
16th " "	359	23	404	1300	1130	170	13·0	543	41·76	1025·25	...	...	...	...	...	
23rd " "	360	24	411	1300	1195	105	8·0	630	48·46	1025·50	...	...	...	...	...	
26th " "	366	...	414	Injected 4000 c. c. V. B. $\left\{\frac{1450}{1040}+\frac{2550}{1042}\right\}$. Reaction 41·1°C.; *good*, lasting 6 days.												
14th January 1902	371	25	433	1300	1150	150	11·5	565	43·46	1025·25	...	...	...	...	...	
20th " "	355	26	439	1300	1150	150	11·5	565	43·46	1024·75	...	...	...	...	...	

27th ,, ,,	366	27	446	1300	1180	120	9·2	670	43·84	1024·00	...	...	...	...	...
4th February ,,	365	28	454	1300	1180	120	9·2	805	46·53	1023·50	...	...	...	...	...
11th ,, ,,	368	29	461	1300	1170	130	10·0	610	46·92	1024·00	...	...	...	...	...
18th ,, ,,	379	30	468	4820	4320	600	10·3	2200	45·64	1023·25	...	...	...	...	...
18th ,, ,,	365	...	Death												
TOTAL	...	...	...	399.0	35840	4080	10·2	18795	47·08	1027·25 1021·25	Max. Min.	...	...	...	...

Bull No. 704 (hill). Age—Aged.

6th July 1901	427	...	...	Inoculated 103·36 c.c. serum (No. IX) + 0·5 c c. V.B. (726, 48 hrs. old). Reaction 40·0°C.; *poor*, lasting 1 day.											
18th ,, ,,	446 (after Inj.)	...	14	Injected 4350 c.c. V. B. {2200—760, 2150—761}. Reaction 40·3°C.; *fair*, lasting 3 days.											
29th ,, ,,	466	...	25	Injected 6450 c.c. V. B. {2500—771, 1700—772, 2250—731}. Reaction 39·9°C.; *poor*, lasting 9 days.											
19th August ,,	448	1	48	2000	1985	216	9·7	1090	49·54	1030·00	...	...	...	20	1163
28th ,, ,,	407	2	53	2000	1795	206	10·2	916	45·75	1028·00	...	...	...	...	...
2nd September ,,	464	3	60	2000	1860	150	7·5	1100	55·00	1025·50	...	...	...	...	...
9th ,, ,,	476	4	69	2000	1880	120	6·0	1170	58·50	1024·00	...	...	...	250	1440
14th ,, ,,	...	...	74	Injected 8065 c.c. V. B. {4115—856, 3950—856}. Reaction 40·3°C.; *fair*, lasting 7 days.											
3rd October ,,	483	5	94	2000	1810	100	9·5	800	40·00	1027·75	...	...	...	35	1212 1351

Simultaneous method followed by two injections of V. B., second larger than the first—concluded.

Bull No. 704 (hill). Age—Aged—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
						Amount.	Per cent.	Quantity.	Per cent.			PLAINS BREED. Dose.	PLAINS BREED. No. of animal.	HILL BREED. Dose.	HILL BREED. No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
10th October 1901 . .	464	6	101	2000	1810	190	9·5	1010	50·50	1024·50	...	...	...	...	...	
17th ,, ,, . .	485	7	108	2200	2040	160	7·2	1170	53·18	1024·00	...	...	...	...	...	
24th ,, ,, . .	495	9	115	2400	2180	220	9·1	1150	47·91	1026·00	...	...	...	...	...	
31st ,, ,, . .	500	9	122	2400	2240	160	6·8	1090	45·41	1025·00	...	...	...	...	...	
7th November ,, . .	493	10	129	2400	2215	185	7·7	1300	54·16	1024·50	...	...	...	...	...	
9th ,, ,, . .	...	...	130	Injected 4150 c.c. V. B, { 2150 964 2000 - 965 }. Reaction 40·1°C.; *fair*, lasting 7 days.												
2nd December ,, . .	497	11	154	6915	6175	740	8·3	1740	25·16	1025·50	...	...	...	...	...	
2nd ,, ,, . .	Death															
TOTAL .	...	...	...	28515	25980	2535	8·9	12535	43·95	1030·00 10 4·00	Max. Min.	...	...	...	...	

Massive simultaneous method.

Bull No. 1116 (hill). Age 6½ years.

25th February 1902	313	...	1	Injected 3500 c.c. V. B. (1224) +150 c.c. (Serum No. X). Reaction 40·6°C.; *good*, lasting 11 days.												
21st March ,,	354	1	25	1500	1380	120	8·0	920	61·33	1026·50	...	...	...	90 180 300	...	Death.
28th ,, ,,	350	2	32	1500	1320	180	12·0	980	65·33	1025·25	...	...	...	...	...	
4th April ,,	352	3	30	1500	1335	165	11·0	890	59·33	1025·75	...	...	...	...	...	
7th ,, ,,	346	...	42	Injected 4000 c.c. V. B. $\left\{\frac{3600}{1375}+\frac{400}{1374}\right\}$. Reaction 40 7°C.; *good*, lasting 5 days.												
28th ,, ,,	352	4	63	1500	1385	115	7·6	870	58·00	1029·00	...	...	...	...	...	
5th May ,,	372	5	70	1500	1280	220	14·6	840	56·00	1027·50	...	...	...	...	...	
12th ,, ,,	378	6	77	1500	1330	170	11·3	800	53·33	1027·50	...	...	...	...	...	
19th ,, ,,	404	7	84	1500	1310	190	12·6	800	53·33	1026·25	...	...	...	...	...	
26th ,, ,,	414	8	91	1500	1345	155	10·3	895	59·66	1026·00	...	...	...	...	...	
2nd June ,,	417	9	98	1500	1310	190	12·6	865	57·66	1025·50	...	...	...	...	...	
6th ,, ,,	427	...	102	Injected 4000 c.c. V. B. $\left\{\frac{1900}{1488}+\frac{2100}{1495}\right\}$. Reaction 40·7°C.; *good*, lasting 6 days.												
3rd July ,,	421	10	129	2000	1730	270	13·5	975	48·75	1029·50	10·2920	...	...	...	...	
10th ,, ,,	454	11	136	2000	1800	200	10·0	865	43·25	1027·25	9·9800	...	...	...	...	
17th ,, ,,	444	12	143	2000	1660	340	17·0	945	47·15	1027·00	9·1960	...	...	...	...	
24th ,, ,,	437	13	150	2000	1770	230	11·5	1085	54·25	1027·00	9·7980		...	...	...	

Massive simultanecus method—concluded.

Bull No. 1116 (hill). Age 6½ years—*concluded*.

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINS.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	8	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
31st July 1902 . .	431	14	157	2000	1655	345	17·2	895	44·75	1027·75	9·9720	...	...	...	...	
2nd August „ . .	413	...	159	Injected 4200 c.c. V. B. $\left\{\frac{2000}{1663}+\frac{2200}{1771}\right\}$. Reaction 41°C.; *good*, lasting 7 days.												
1st September „ . .	426	15	189	2000	1700	309	15·0	905	45·25	1028·50	11·2400	...	...	...	...	
8th „ „ . .	448	16	196	2000	1695	305	15·2	980	49·00	1026·50	9·6080	...	...	...	...	
15th „ „ . .	458	17	203	4500	4015	485	10·7	2155	47·88	1025·75	8·9680	...	...	...	...	
20th „ „ . .	...	...	...	Discontinued.												
TOTAL .	...	...	...	32000	28020	3980	12·4	18665	52·07	1029·50 102[illegible]·25	Max. Min.	...	...	...	...	

Massive simultaneous method followed by large dose of V. B.

Bull No. 1080 (hill). Age over 5 years.

6th January	1902	305	...	1	Injected 1850 c.c. V. B. (1074+1075) + 150 c.c. Serum (No. X.). Reaction 40·9°C.; *good*, lasting 9 days.											
30th ,,	,,	...	...	25	Injected 2150 c.c. V. B. $\left\{\frac{1850}{1131}+\frac{200}{1149}\right\}$. Reaction 40·7°C.; *good*, lasting 6 days.											
24th February	,,	293	1	50	1400	1265	135	9·6	785	56·07	1030·00	11·8280	...	...	80	1965
3rd March	,,	292	2	57	1400	1260	140	10·0	760	54·28	1029·00	10·9100	...	...	...	...
10th ,,	,,	291	3	64	1400	1290	110	7·8	820	58·57	1028·00	11·0000	...	...	...	...
17th ,,	,,	298	4	71	1400	1300	100	7·1	810	57·85	1027·25	10·8940	...	...	...	...
24th ,,	,,	283	5	78	1400	1305	95	6·7	790	56·42	1028·25	9·9760	...	...	..	...
31st ,,	,,	282	6	85	1400	1245	155	11·0	795	55·78	1028·00	9·9080	...	...	...	...
TOTAL		...	...	...	8400	7655	735	8·7	4760	56·66	1030·00 1027·25	Max. Min.	...	...	...	...

Bull No. 1081 (hill). Age 5 years.

6th January	1902	315	...	1	Injected 1850 c.c. V. B. (1074+1075) + 150 c.c. Serum (No. X.). Reaction 40·4°C.; *fair*, lasting 2 days.											
30th ,,	,,	...	...	25	Injected 2150 c.c. V. B. $\left\{\frac{2000}{1157}+\frac{150}{1131}\right\}$ Reaction 40·3°C.; *fair*, lasting 3 days.											
22nd February	,,	322	1	48	1500	1330	140	9·2	660	44·00	1027·25	...	...	...	135	1957 2077
1st March	,,	317	2	55	1400	1250	150	10·7	740	52·85	1026·75	...	...	...	...	...
8th ,,	,,	333	3	62	5044	4540	504	9·9	2560	50·75	1024·00	...	...	...	...	...
8th ,,	,,	327.	Death													
TOTAL		...	...	...	7944	7150	794	9·9	3960	49·84	1027·25 1024·00	Max. Min.	...	...	...	...

Massive simultaneous method followed by large dose of V. B.—concluded.

Bull No. 1225 (hill). Age 5 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
						Amount.	Per cent.	Quantity.	Per cent.			Plains Breed. Dose.	Plains Breed. No. of animal.	Hill Breed. Dose.	Hill Breed. No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
21st February 1902	334	...	1	Injected 1350 c.c. V. B. (1223) + 150 c.c. serum (No. X). Reaction 40·4°C.; *fair*, lasting 7 days.												
10th March „	...	...	18	Injected 3000 c.c. V. B. $\left\{\frac{2000}{1264}+\frac{1000}{1263}\right\}$. Reaction 40·6°C.; *good*, lasting 6 days.												
31st „ „	318	1	39	1500	1385	115	7·6	760	50·00	1028·00	...	...	...	135	1956 1906	
7th April „	333	2	46	1500	1415	85	5·6	760	50·66	1030·25	...	...	...	...	...	
14th „ „	326	3	53	1500	1395	105	7·0	620	41·33	1028·75	...	...	...	...	...	
21st „ „	349	4	60	1500	1385	115	7·6	765	51·00	1027·50	...	...	...	...	...	
28th „ „	344	5	67	1500	1120	380	25·3	735	49·00	1026·75	...	...	...	...	...	
6th May „	380	6	74	1500	1345	155	10·3	810	54·00	1036·25	...	...	...	...	...	
11th „ „	...	...	80	Injected 2700 c.c. V. B. (1449). Reaction 40·6° C.; *fair*, lasting 5 days.												

31st „ „ . .	384	7	100	1500	1370	130	8·6	600	40·00	1030·00	...	...	...	...	...
7th June „ . .	413	8	107	1500	1365	135	9·0	790	52·66	1028·75	...	...	...	...	...
14th „ „ . .	432	9	114	1500	1260	240	16·0	760	50·66	1028·00	...	...	...	...	...
21st „ „ . .	413	10	121	1500	1340	160	10·6	590	39·33	1028·50	...	...	...	...	...
28th „ „ . .	411	11	128	1500	1245	255	17·0	510	34·00	1026·00	...	...	...	...	...
5th July „ . .	409	12	135	1500	1315	185	12·3	610	40·66	1027·50	...	...	...	...	...
22nd „ „ . .	405	...	152	Injected 3400 c.c. V. B. $\left\{\frac{1600}{1746}+\frac{1600}{1743}\right\}$. Reaction 40·4°C.; *fair*, lasting 4 days.											
11th August „ . .	402	13	172	1500	1070	430	28·6	536	35·66	1028·25	...	...	...	...	...
18th „ „ . .	399	14	179	1500	1370	130	8·6	740	49·33	1026·75	...	...	...	...	...
25th „ „ . .	412	15	186	1500	1400	100	6·6	660	44·00	1027·25	...	...	...	...	...
1st September „ . .	381	16	193	1500	1280	220	14·6	600	40·00	1027·25	...	...	...	...	..
8th „ „ . .	369	17	200	1500	1365	135	9·0	650	43·33	1026·25	...	...	...	...	...
15th „ „ . .	413	18	20	1500	1450	50	3·3	730	48·66	1025·25	...	...	...	...	...
13th „ „ . .	372	...	...	Injected 4000 c.c. V. B. $\left\{\frac{1600}{1862}+\frac{1600}{1638}+\frac{800}{1643}\right\}$. Reaction 40·9°C.; *good*, lasting 5 days											
9th October „ . .	421	19	231	1500	1405	95	6·3	490	32·66	1029·00	...	...	...	...	...
16th „ „ . .	421	20	237	1500	1405	95	6·3	500	33·33	1029·75	...	...	...	...	...
22nd „ „ . .	406	21	244	1500	1400	100	6·6	670	38·00	1028·25	...	...	...	...	...
26th „ „ . .	...	22	248	4807	4370	437	9·0	2540	52·83	1026·25	...	...	...	...	...
	Discont	inued.													
TOTAL .				36307	32456	3652	10·6	18315	44·93	1030·25 1025·25	Max. Min.	...	...	...	...

BUFFALOES.

Simultaneous method followed at intervals with increasing doses of Buffalo V. B.

Buffalo No. I (plains). Age 5 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
4th April 1900	808	...	1	Inoculated 20·25 c.c. serum (No. VI) + 1 c.c. V. B. (309). Reaction 39·5°C.; *Nil.*												
21st ,, ,,	...	...	18	Injected 500 c.c. V. B. (Buff. 3). Reaction 40·1° C.; *poor*, lasting 2 days.												
19th May ,,	822	...	46	Injected 1000 c.c. V. B. (Buff. 6). Reaction 39·4° C.; *Nil.*												
8th June ,,	839	1	66	3000	2550	450	15·0	1460	46·66	1028·00	...	4·4	...	80	562	
15th ,, ,,	856	2	73	3500	2900	540	15·4	1740	49·71	1026·50	...	...	...	...	...	
22nd ,, ,,	812	3	80	3000	2800	200	6·6	1370	46·33	1027·00	...	...	...	...	...	
23rd ,, ,,	...	...	81	Injected 2000 c.c. V. B. (Buff. 7). Reaction 39·7° C.; *Nil.*												
13th July ,,	802	4	101	3000	2520	480	16·0	1615	53·83	1028·00	...	4·2	...	75	510	
20th ,, ,,	795	5	108	3000	2685	315	10·5	1565	52·83	1026·25	...	...	...	...	...	
27th ,, ,,	828	6	115	3500	3090	410	11·7	1985	56·71	1023·50	...	...	...	...	...	

30th ,,	,,	...	...	118	Injected 3000 c.c. V, B. (Bnff. 10). Reaction 39·8° C.; *Nil.*											
22nd August	,,	817 852	7	141	3500	3210	290	8·2	1990	56·85	1027 50	...	8·7	...	120	783
29th ,,	,,	827	8	148	3000	2610	390	13·0	1625	54·16	1027·25	...	...	...	...	...
6th September	,,	859	8	155	3500	3030	470	13·4	1736	49·57	1028 75	...	...	...	...	...
16th November	,,	871	...	196	Injected 4000 c.c. V. B. (Buff. 8). Reaction 39·2° C.; *Nil.*											
6th December	,,	770	10	216	2500	2110	390	15·6	1140	45·00	1029·50	...	8·3	...	150	820
13th ,,	,,	644	11	223	3000	2720	280	9·3	1480	49·33	1028·00	...	...	...	...	...
20th ,,	,,	828 643	12	230	3000	2800	200	6·6	1590	53 00	1027·25	...	...	...	...	...
27th April	1901	902	...	358	Injected 5000 c.c. V. B. (Buff 16). Reaction 41·1° C.; *good*, lasting 6 days.											
15th May	,,	937	13	377	3500	3200	300	8·5	1700	48·57	1026·25	...	8 3	...	150	856
23rd ,,	,,	925	14	384	3500	3080	420	12·0	1757	50·20	1024·00	...	...	...	...	...
30th ,,	,,	923	15	391	3500	3115	385	11·0	1680	48·00	1022·50	...	...	...	...	...
1st June	,,	904	...	393	Injected 6035 c.c. V. B. $\left\{\frac{3035}{\text{Buff. 19}}+\frac{3000}{\text{Buff. 20}}\right\}$. Reaction 40·7°C.; *good*, lasttng 4 days.											
22nd ,,	,,	936	16	414	3500	3025	475	13·5	1840	52·57	1025·25	...	6·3	...	150	951
29th ,,	,,	973	17	421	3500	3225	275	7·8	1600	51·42	1024·00	...	...	...	...	...
6th July	,,	1063	18	428	3600	3160	440	12·2	2025	56·25	1023·75	...	...	...	...	...
7th ,,	,,	...	...	429	Injected 7000 c.c. V. B. $\left\{\frac{4750}{\text{Buff. 21}}+\frac{1750}{22}+\frac{500}{23}\right\}$. Reaction 40·6° C.; *good*, lasting 5 days.											
29th ,,	,,	970	19	451	3500	2950	550	15·7	1815	51·85	1026·00	...	6·1	...	110	1220
6th August	,,	970	20	458	3500	3135	365	10·4	1005	54·42	1024·00	...	...	...	...	...
12th ,,	,,	947	21	465	3500	3130	370	10·5	1860	53·14	1024·75	...	...	...	...	...

Simultaneous method followed at intervals with increasing doses of Buffalo V. B.— concluded.

Buffalo No. I (plains). Age 5 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 600 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
13th August 1901 . .	...	...	465	Injected 8000 c.c. V. B. $\left\{\frac{3400}{\text{Buff. }25}+\frac{2700}{26}+\frac{1900}{\text{B}792}\right\}$. Reaction 40·4° C.; *fair*, lasting 6 days.												
3rd September ,, . .	933	22	487	3000	2580	420	14·0	1500	50·66	1027·25	...	9·7	...	175	1321	
12th ,, ,, . .	943	23	496	3500	3190	310	8·8	1705	48·71	1025·00	..	...	...	...	...	
17th ,, ,, . .	944	24	501	3500	3120	380	10·8	1815	51·85	1023·50	...	...	...	...	...	
20th November ,, . .	978	...	534	Injected 6000 c.c. V. B. $\left\{\frac{4150}{\text{Buff. }42}+\frac{850}{\text{Buff. }44}\right\}$. Reaction 41·4° C.; *good*, lasting 1 day.												
12th December ,, . .	954 Death	25	555	11430	10100	1330	11·6	6700	58·61	1026·00	...	...	...	...	...	
TOTAL .				90530	81095	9435	10·4	47377	52·33	1029·50 1022·50	Max. Min.	...	...	...	...	

Simultaneous method followed by one injection V. B. (Buffaloes).

Buffalo No. II (plains). Age 7 years.

4th April	1900	901	...	1	Inoculated 22·5 c.c. serum (No. VI) + 1 c.c. V. B. (309). Reaction 39° C.; *Nil.*											
21st „	„	...	...	18	Injected 6000 c.c. V. B. (Buff 3.) Reaction 40·2° C.; *fair*, lasting 4 days.											
9th May	„	962	1	36	3500	2985	615	17·6	1580	45·14	...	...	1·7	...	30	695
17th „	„	1006	2	44	3000	2486	616	17·1	1192	39·73	...	...	...	...	...	...
23rd „	„	1008	3	60	3500	3040	460	13·4	1605	45·85	...	...	...	...	...	...
30th „	„	986	4	67	3000	2650	360	11·7	1360	45·33	...	...	...	...	...	...
6th June	„	972	5	64	2500	2240	260	10·4	1420	56·20	1029·00	...	...	...	...	...
13th „	„	997	6	71	3000	2630	470	15·6	1690	53·00	1029·00	...	...	...	...	...
20th „	„	1011	7	78	3500	3426	75	2·1	1660	47·42	1027·50	...	...	...	...	...
27th „	„	970	8	85	3000	2655	345	11·5	1666	52·16	1027·00	...	...	...	...	...
4th July	„	969	9	92	3000	2660	340	11·3	1650	55·00	1027·60	...	...	...	...	...
11th „	„	940	10	99	2500	1976	526	21·0	1280	51·20	1027·50	...	...	...	...	...
18th „	„	959	11	108	3000	2680	320	10·6	1686	52·83	1025·00	...	...	...	...	...
26th „	„	992	12	113	3500	3150	350	10·0	1765	50·42	1025·50	...	6·6	...	100	696
25th August	„	919	13	144	3000	2410	660	18·6	1365	45·50	1030·25	...	...	...	...	...
25th September	„	923	14	175	3000	2650	350	11·6	1170	39·00	1028·60	...	...	...	...	...
26th October	„	930	15	205	3000	2455	645	18·1	1445	48·16	1031·00	..	13·9	...	250	752
28th November	„	900	16	237	3000	2500	600	16·6	1280	42·66	1029·75	...	...	...	...	...
23rd December	„	920	17	264	3000	2700	300	10·0	1350	45·00	1030·00	...	...	...	...	...
25th January	1901	832	18	297	2000	1775	225	11·2	830	41·50	1020·50	...	19·4	...	350	778
25th February	„	982	19	328	3000	2675	325	10·8	1250	41·66	...	...	...	...	...	...
25th March	„	948	20	356	2500	2220	280	11·2	1050	42·00	1027·75	...	...	...	...	...
26th April	„	899	21	387	2500	2180	320	12·8	1205	48·20	1026·00	...	19·4	...	350	754

Simultaneous method followed by one injection V. B. (Buffaloes)—continued.

Buffalo No. II (plains). Age 7 years—*concluded.*

MONTH AND DATE.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	FIBRINE.		SERUM.		Specific gravity of pure serum.	Percentage of total proteids in serum.	PROTECTIVE VALUE PER 800 LBS. BODY WEIGHT.				REMARKS.
												PLAINS BREED.		HILL BREED.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c c.		
5th May 1901 . .	957	...	397	Injected 3500 c.c. V. B. (Buff. 17). Reaction 40·2° C. (after inj.); *Nil*												
16th „ „ . .	992	...	408	Injected 3900 c.c. V. B. (Buff. 18). Reaction 39·9° C. ; *poor*, lasting 1 day.												
5th June „ . .	989	22	428	3000	2540	480	15·3	1400	46·66	1028 00	...	11·1	...	200	1138	
12th „ „ . .	1026	23	435	3500	3025	475	13·5	1740	49·71	1023·00	...	...	...	...	...	
19th „ „ . .	1006	24	442	3000	2580	420	14·0	1540	51·33	1025·50	...	...	...	...	...	
1st July „ . .	...	...	454	Injected 1800 c.c. V. B. $\left\{\frac{250}{730}+\frac{850}{722}+\frac{900}{725}\right\}$. Reaction 39·8° C. ; *Nil.*												
7th „ „ . .	...	...	460	Injected 3500 c.c. V. B. Buff. $\left\{\frac{500}{21}+\frac{500}{22}+\frac{2500}{23}\right\}$. Reaction 39·8° C. ; *Nil.*												
24t „ „ . .	983	...	477	Injected 4635 c.c. V. B. $\left\{\frac{2800}{765}+\frac{2035}{766}\right\}$. Reaction 40·5° C. ; *fair*, lasting 4 days.												

14th August ,, . .	995	25	496	3500	3035	465	13·2	1440	41·14	1031·00	...	...	...	...	...	Serum tested in bulk.
22nd ,, ,, . .	1022	26	506	3500	3070	430	12·2	1460	41·71	1029·00	...	...	...	...	...	
28th ,, ,, . .	1018	27	512	3500	3170	330	9·4	1650	47·42	1027·00	...	...	...	...	...	
4th September ,, . .	1014	28	519	3500	2990	510	14·5	1640	46·85	1028·25	...	...	...	...	...	
11th ,, ,, . .	993	29	526	3300	2900	400	12·1	1595	48·33	1027·00	...	...	...	...	...	
18th ,, ,, . .	1041	30	533	3500	3150	350	10·0	1695	48·44	1025·75	...	...	...	...	...	
16th October ,, . .	...	Death														
TOTAL .				92300	80430	11870	12·86	43367	46·98	1031·00 1023·00	Max. Min.	...	...	...	...	

Buffalo No. 60 (plains). Age 2 years.

27th September 1902 . .	513 478	Inoculated 4·78 c.c. serum (No. XV)+1 c.c. V. B. (1832—72 hrs. old). Reaction 41·3°C.; *good*, lasting 11 days.													
20th October ,, . .	497	...	23	Injected 6000 c.c. V. B. $\left\{\frac{4200}{\text{Buff. 57}}+\frac{1600}{\text{Buff. 56}}\right\}$ Reaction 40·3°C.; *fair*, lasting 11 days.											
13th November ,, . .	...	1	47	2500	...	...	...	1350	54·00	...	...	...	...	52	2134 2170
20th ,, ,, . .	...	2	54	2500	...	...	...	1520	60·80	...	...	...	...	...	...
27th ,, ,, . .	...	3	61	2500	...	...	...	1420	56·80	...	...	...	...	...	...
4th December ,, . .	...	4	68	2500	...	...	...	1320	52·80	...	...	...	...	...	...
11th ,, ,, . .	...	5	75	2500	...	...	...	1480	59·20	...	...	...	...	...	...
17th ,, ,, . .	...	6	81	2500	...	...	...	1400	56·00	...	...	...	...	...	...
16th March 1903 . .	693	...	170	Injected 6000 c.c. V. B. $\left\{\frac{3150}{2064}+\frac{1750}{2062}+\frac{1100}{2069}\right\}$ Reaction 40·6° C.; *good*, lasting 7 days.											

Simultaneous method followed by one injection V. B. (Buffaloes)—concluded.

Buffalo No. 60 (plains). Age 2 years—*concluded.*

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine		Serum.		Specific gravity of pure serum.	Percentage of total proteids in serum.	Protective value per 600 lbs. body weight.				Remarks.
						Amount.	Per cent.	Quantity.	Per cent.			Plains Breed. Dose.	Plains Breed. No. of animal.	Hill Breed. Dose.	Hill Breed. No of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.							
7th April 1903 . .	715	7	192	3000	...	...	...	1370	45·66	...	...	...	...	...	...	
14th ,, ,, . .	714	8	199	3000	...	...	...	1420	47·33	...	...	...	...	...	...	
21st ,, ,, . .	707	9	206	3000	...	...	...	1530	51·00	...	...	...	...	...	...	
28th ,, ,, . .	749	10	213	3000	...	...	...	1600	53·33	...	...	...	...	...	...	
5th May ,, . .	740	11	220	3000	...	...	...	1600	53·33	...	...	...	...	...	...	
12th ,, ,, . .	753	12	227	3000	...	...	...	1560	52·00	...	...	...	...	...	...	
19th ,, ,, . .	735	...	234	Injected 7000 c. c. V. B.				$\left\{\frac{1800}{2136}+\frac{2800}{2135}+\frac{2400}{2162}\right\}$		Reaction 41·6°C.; *good*, lasting 6 days.						
12th June ,, . .	746	13	268	9300	8620	880	9·2	5340	56·21	...	...	...	...	...	...	
12th ,, ,, . .	Death															
Total .				42 00	8620	880	...	22910	53·90	...	...	...	...	...	...	

Protected with 10 c.c. V. B. followed at interval by one injection V. B. Hill Bovine Control.

Buffalo No. 40 (hill). Age 1 year.

14th November 1902	254	...	1	Inoculated 10 c. c. V. B. (956) direct. Reaction 39·8° C. ; *Nil.*											
7th February ,,	279 273	...	88	Injected 5200 c.c. V. B. $\left\{\frac{1300}{1177}+\frac{1200}{1175}+\frac{2700}{1174}\right\}$ Reaction 41·3°C.; *good*, lasting 8 days.											
6th March ,,	297	1	113	2200	2050	150	6·8	1190	54·09	1025·00	9·8280	...	...	100	1434
13th ,, ,,	299	2	120	2200	2040	160	7·2	1240	56·36	1023·25	8·2000	...	...	...	...
20th ,, ,,	317	3	127	2500	2255	245	9·9	1595	63·80	1023·25	7·2000	...	...	...	...
27th ,, ,,	308	4	134	2500	2275	225	9·0	1660	66·40	1023·50	7·6300	...	...	...	...
3rd April ,,	316	5	141	2500	2280	220	8·8	1775	71·00	1023·50	7·3600	...	...	...	...
10th ,, ,,	294	6	148	2500	2270	230	9·2	1745	69·80	1022·00	7·0940	...	...	...	...
13th ,, ,,	...	...	151	Injected 4500 c.c. V. B. $\left\{\frac{2700}{1363}+\frac{1800}{1360}\right\}$ Reaction 41·6°C. ; *good*, lasting 5 days.											
7th May ,,	315	7	175	2500	2200	300	12·0	1715	68·60	1025·50	9·1880	...	...	...	...
14th ,, ,,	327	8	182	2500	2190	310	12·4	1655	66·20	1024·25	7·9440	...	...	...	...
21st ,, ,,	331	9	189	2500	2110	390	15·6	1680	67·20	1023·00	7·7900	...	...	...	...
28th ,, ,,	336	10	196	2500	2270	230	9·2	1760	70·40	1022·75	7·6240	...	...	...	...
4th June ,,	335	11	203	2500	2170	830	13·2	1745	69·80	1022·00	7·2125	...	...	...	...
17th ,, ,,	335	...	...	Injected 5000 c.c. V. B. $\left\{\frac{2900}{1520}+\frac{2100}{1521}\right\}$ Reaction 40·9°C. ; *good*, lasting 3 days.											
12th July ,,	317	12	229	4000	3100	900	22·5	2125	53·12	1025·75	10·8160	...	...	...	...
14th ,, ,,	...	...	...	Discon	tinned.										
TOTAL	...	...	...	30900	27210	3690	11·9	19895	64·35	1028·00 1020·50	Max. Min.	...	...	...	...

Massive simultaneous injection of V. B. + serum followed at intervals by two more injections of V. B.

Buffalo No. 33 (hill). Age 4 years.

Month and date.	Body weight.	No. of bleedings.	No. of days intervening.	Amount of blood drawn.	Defibrinated blood.	Fibrine.		Serum.		Specific gravity of pure serum.	Percentage of total proteide in serum.	Protective value per 600 lbs. body weight.				Remarks.
												Plains Breed.		Hill Breed.		
						Amount.	Per cent.	Quantity.	Per cent.			Dose.	No. of animal.	Dose.	No. of animal.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	lbs.			c.c.	c.c.	Grms.	Grms.	c.c.	c.c.			c.c.		c.c.		
19th November 1901 . .	465	...	1	Injected 3560 c.c. V. B. $\left\{\frac{3080}{\text{Buff. } 41}+\frac{175}{37}+\frac{325}{971}\right\}$ + 200 c.c. serum (No. X). Reaction 41·4° C.; *good*, lasting 10 days.												
8th December ,, . .	...	...	20	Injected 2650 c.c. V. B. (Buff. 45). Reaction 40·8°C.; *good*, lasting 5 days.												
22nd ,, ,, . .	...	...	34	Injected 5190 c.c. V. B. $\left\{\frac{2090}{\text{Buff. } 47}+\frac{3100}{\text{Buff. } 48}\right\}$ Reaction 40·7°C.; *good*, lasting 8 days.												
15th January 1902 . .	480	1	58	2500	2220	280	11·2	1470	58·80	1028·25	9·9540	Computed at 1/18 dose required for hill cattle.	...	50	1248	
22nd ,, ,, . .	477	2	65	2500	2280	220	8·8	1500	60·00	1027·00	10·3320		...	...	...	
29th ,, ,, . .	481	3	72	2500	2140	360	14·4	1530	63·20	1028·00	9·2020		...	...	...	
5th February ,, . .	463	4	79	2500	2320	180	7·2	1540	61·60	1026·00	9·4000		...	...	...	
12th ,, ,, . .	481	5	86	2500	2280	220	8·8	1320	52·80	1025·50	9·5320		...	...	...	
19th ,, ,, . .	490	6	93	2500	2220	280	11·2	1500	60·00	1025·60	9·4760		...	...	.	
20th ,, ,, . .	490	... Death	94	...	...	...	...	...	...	...	...		...	...	...	
Total .	...	...	...	15000	13460	1540	10·2	8910	59·40	1028·25 1025·60	Max. Min.		... ...	... ...	... ...	

G. I. C. P. O.—No. 890 I. G. C. V. D.—22-8-1905.—60.—P. M. M.